The Validity of Cognitive Assessments via Telecommunication Links

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DECLARATION

I hereby declare that, apart from the acknowledged help,
this thesis is all my own work.

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ABSTRACT

The use of telecommunication links in health care provision is a rapidly growing field. However, there is concern that as technology advances, teleconsultation will be seen as the method of choice without adequate research as to its efficacy. Preliminary evidence suggests that cognitive assessment of adult psychiatric patients could be reliably carried out using videoconferencing equipment, and this study was designed to investigate the use of videoconferencing for the cognitive assessment of individuals with a history of alcohol abuse. Twenty seven participants were given a range of cognitive assessments, each with two equivalent forms. One of the forms was given via the telelink, the other face-to-face. All participants were assessed using both mediums and the order of presentation of the forms was counterbalanced across participants. Participant satisfaction with teleconsultations was also assessed. There was no significant difference in the majority of assessment outcome measures via telelink in comparison with face-to-face assessment. The majority of participants rated the teleconsultation positively, although some complained about the poor sound quality. The results are discussed with reference to the future developments and limitations of telecommunication links in a rural health care setting.

CHAPTER 1 INTRODUCTION

From telephones and fax machines to television and the Internet, telecommunication links are a fundamental aspect of everyday life for the majority of people in the western world. The advanced sophistication and affordability of telecommunications equipment combined with the need to provide a quality health service to all individuals has led to an increased interest in its potential for health care provision (Perednia & Allen 1995; Coles 1995; Curry & Norris 1997). Enthusiasts have welcomed this challenge, however many have raised concern that the development and adaptation of telecommunication links for health purposes is being led by technology rather than clinical need (Wyatt, 1996). The aim of this study is to look at the application of telemedicine within the area of cognitive assessment and to investigate the reliability and validity of using telecommunications in this way.

This thesis begins by defining telemedicine and looks at how it has developed from its inception in the 1950's to the more advanced systems of the 1990's. The various applications of telecommunication technology within the health service are then briefly described. The many advantages and disadvantages of telemedicine are discussed, followed by a look at how people have responded to its introduction and what factors of the communication process are potentially affected by telemedicine. Particular emphasis is placed on reporting developments within mental health services. The research findings of previous studies which have used telecommunication links for psychological assessment are presented before outlining the background to the current study, which investigates the use of telecommunications for cognitive assessment in the Highlands of Scotland.

1.1 WHAT IS TELEMEDICINE ?

Telemedicine involves the use of telecommunications to provide medical and other health services at a distance. The most important telecommunication systems to date have been the telephone, telegraph, telex, facsimile and information systems based on the telephone or television. Recently the term telecommunications has been more commonly applied to sophisticated computer and interactive video communication, but the lack of clear and consistent use of terms and definitions in the field has led to some confusion (Preston, 1992). For example, 'telemedicine' has been used to describe many different processes such as the one way transmission of data and X-ray images from one site to another or the live-two way audiovisual communication between a doctor and a patient. Despite the extensive range of definitions of telemedicine, they all have the same common theme of 'medicine at a distance'. Some definitions have focused on the role of the patient, for example:

> *Remote, telematic healthcare; using information and communication systems to give patients with their healthcare workers access to relevant information sources wherever they are located.*
> (Norris, Curry & Parroy, 1996, p. 5).

However, the majority of definitions include all aspects of telemedicine regardless of the need for direct patient contact, for example:

> *(telemedicine is...) the use of modern information technology, especially two-way interactive audio/video telecommunications, computers and telemetry, to deliver health services to remote*

patients and to facilitate information exchange between primary care physicians and specialists at some distances from each other. (Bashur, 1997, p. 9).

In this study a range of terms have been used to describe telecommunication systems. Unless otherwise stated, the following terms will be consistently used throughout to describe the process of live two-way audiovisual communication between a health professional and patient at a distance: telemedicine, teleconsultation, telecommunication link, telelink, videoconferencing, video-link, remote consultation and interactive television.

1.2 THE HISTORY OF TELEMEDICINE

Telemedicine was first used in the USA in the late 1950's. At Nebraska Psychiatric Institute, Wittson, Affleck & Van Johnson (1961) successfully conducted an early trial of group therapy with adult inpatients using two-way television. In 1968 an interactive television microwave link was established between Massachusetts General Hospital in Boston and a medical station at the city's Logan Airport. One of the most successful uses of this telemedicine system was in psychiatry despite the psychiatrists initial misgivings that the lack of face-to-face proximity would have a negative effect on consultations (Dwyer, 1973).

Massachusetts General Hospital also provided telepsychiatric services to the Veterans Affairs Hospital in Bedford, Massachusetts, beginning in 1968. In the 1970's services were expanded to schools and courts in the community and to a nearby prison. Dwyer (1973) reported that for many of these patients, in

particular young children, adolescents, and some adults with schizophrenia, communication via the video-link was found to be more comfortable than face-to-face interviews.

STARPAHC (Space Technology Applied to Rural Papago Advanced Health Care) was another early influential project. This was a joint project of the National Aeronautics and Space Administration (NASA) and the U.S. Public Health Service (Justice & Decker, 1979). The programme had two main aims: to carry out research in using audio and audiovisual telecommunication to provide medical services to astronauts in space; and to provide general medical services to Indian communities on the reservation. This was done with the use of a van which was outfitted as an examining room, with a variety of medical equipment including x-ray and electrocardiograph, and was staffed by two paramedics. The van was connected by two-way microwave television and audio transmission to a Public Health Service hospital and to a second hospital with a variety of specialists. The project successfully provided medical treatment to remote sites on the Indian reservation for 20 years until it folded due to lack of maintenance funding.

Lack of system management was also one of the reasons why STARPAHC and many of the other early telemedicine programmes failed to continue despite high satisfaction reported by providers and patients. Because the provision of telemedical services were not under the control of any one department, lines of authority and responsibility were unclear or absent. Preston (1992) also claimed that the difficulty with the early telemedicine programmes was that they were ahead of their time and many individuals were not used to the advanced technology or were inadequately trained in how to use the systems.

Cost was a major hindrance in the development of the early telemedicine projects as the equipment was very expensive. With the introduction of digital

data transmission methods and cheaper equipment, there has once again been an increase in the number of telemedicine projects. This is illustrated by the corresponding rise in telemedicine publications over the past 20 years from one in 1977 to 920 in 1996.

One example of a recent telemedicine initiative is the RACE (Research and Development in Advanced Communication Technologies in Europe) project which was started in the early 1990's. Its main objectives are:

> *To make a major contribution towards the implementation of integrated broadband communications (IBC) in Europe and to contribute to regional development within the community, by allowing less developed regions to benefit fully from telecommunications developments .*
> (Gott, 1995, p. 92).

As part of this initiative video-link pilot projects in Germany and Portugal have been set up. These provide active information and care for elderly people living alone and and also support for carers via a two-way television monitor in the person's home which is linked to a central service centre. The system has been successful in providing remote home care for the elderly and in reducing social isolation. The initiative has supported other telemedicine projects including the development of telepsychiatry in an inner city community psychiatric service in the UK (McLaren, Blunden, Lipsedge & Summerfield, 1996).

The recent revival in the popularity of telemedicine has been fuelled by the increasing need to look for efficient and cost effective ways to provide a high quality health service to people living in remote areas where current health service delivery is sparse or non-existent.

1.3 TELEMEDICINE APPLICATIONS

Existing telemedicine applications can be divided into at least three categories (Coles, 1995):

1.31 Remote diagnosis and consultation

The first profession to make widespread use of telemedicine were radiologists. Radiology is well suited to telemedicine which allows the transmission of conventional X-rays, ultra-sound or scanned images using 'store and retrieve' methods between main hospitals and remote settings. Other forward disciplines to adopt telemedicine include pathology, dermatology and cardiology. For example, specimen images can be sent from remote sites to centralised pathologists who are able to view and manipulate a microscope located hundreds of miles away (Eide & Nordrum, 1994). Skin disorders can be diagnosed using still images or live video transmission with the presence of a local practitioner to assist with the examination (Philips, Burke, Shechter, Stone, Balch & Gustke, 1997). Cardiology, which involves a great deal of imaging, has used telecommunications in home based-rehabilitation programmes to transmit ECG and other physiological data over domestic telephone lines from remote areas to centrally-based cardiologists (Sparks, Shaw, Eddy, Hanigosky & Vantrese, 1993). Surgical procedures which require specialist knowledge or experience have been performed by doctors in rural areas under the guidance of experts in a central location (Moore, Adams, Partin, Docimo & Kavoussi, 1996).

As well as enabling direct consultations between practitioners and patients in rural areas Harrison (1996) reports how telecommunication links improved communication between hospital specialists and general practitioners in inner city areas. Within the mental health field, telemedicine has been widely used for the assessment and treatment of psychiatric patients (Ball & McLaren, 1997, Brown,1995).

1.32 Continuing education

Seminars and lectures transmitted over television links allow remote practitioners to keep up to date with new techniques and procedures, and to receive training in subjects not available in their area. For example, post mortem studies are not normally available to students in the United Arab Emirates due to cultural reasons. Brebner, Brebner, Norman, Brown, Ruddick-Bracken & Lanphear (1997) describe an education programme based at the medical school of Aberdeen University which was successful in teaching post-mortem studies to medical students in the United Arab Emirates using videoconferencing equipment. Videoconferencing has also been used in the INSURRECT project which linked six medical schools in Britain for interactive teaching and learning in surgery (Jameson, O'Hanlon, Buckton & Hobsley, 1995).

1.33 Medical informatics

Medical informatics involves the use of information systems and new technologies in the management and integration of medical information and knowledge. As telemedicine increases the availability of health services and

the ability to co-ordinate joint consultations with different professionals, it places an additional burden on administration staff both in the amount of correspondence produced and the need to transfer patient notes between centres. Centralised computer-based records systems have the advantage of allowing all relevant parties to have instant access to a patient's notes prior to a teleconsultation. Current research and information can be downloaded from on-line libraries and central information stores (eg. MEDLINE) for teaching purposes or to clinicians in remote settings who do not have access to libraries.

1.4 TECHNOLOGY

Most telemedicine projects in operation today use standard videoconferencing equipment which has been developed mainly for business use. This compares with the equipment of earlier projects which was developed specifically for the purpose and was therefore more expensive. Although the equipment available now may be less expensive, it still has limitations in that it is being used for purposes for which it was not originally designed and for which it may not be ultimately suited.

Recent advances in telecommunications have had a major impact on telemedicine as domestic telephone networks have been unable to cope with the increased demand for rapid and efficient information transfer. The move to digital communication technology in the late 1980's to 1990's has made it possible for large amounts of data, voice and video information to be compressed and sent at high speed along ISDN lines (Integrated Services Digital Network). Each ISDN line is capable of transmitting at 64 kbts/sec (rate of information flow in digital transmission), and are provided in multiples of

two i.e. ISDN2 carries 128 kbits/sec, ISDN6 384 kbits/sec and so on up to ISDN30. Transmission at 128 kbit/sec over a single ISDN line is capable of transmitting video images of acceptable quality essentially in real time but increasing the transmission speed to 384 kbit/sec using additional ISDN lines improves the picture quality and eliminates the audio time lag of 1-2 seconds that is experienced in the narrow bandwidth. Bandwidth is a measure of the information carrying capacity of a communications channel and therefore increasing the bandwidth increases the amount of information it is possible to transmit. Narrow bandwidth is less expensive and more widely available than broad bandwidth approaches. Approximate costs for ISDN2 are; £99 for installation (compared to £400 two years ago) and a quarterly rental charge of £150. Call charges are double the normal domestic telephone rates. Costs for videoconferencing equipment have dropped dramatically over the last five years, with a top of the range system which would have cost approximately £25,000 five years ago now being purchased for around £8,500. Other computer-based systems such as PictureTel are available. These systems use desktop PC's and are capable of real time data, audio and video transmissio Although these systems can be more expensive than videoconferencing to install, they have a wider range of facilities.

1.5 PROS AND CONS OF TELEMEDICINE

Telemedicine has been regarded, not as a replacement for face-to-face contact but as a partial solution to the many problems encountered in providing good quality health care to individuals in rural locations (Wootton, 1996; Dongier,

Tempier, Lalinec-Michaud & Meunier, 1986). Rural areas experience many problems which although may not be unique to their location are no doubt magnified by it.

1.51 Location

One of the obvious difficulties for health services covering large geographical areas is the increased travelling time for clients when visiting specialist centres or for professionals when visiting clients in their own community. Often it is not economically viable for professionals to travel large distances for a few clients, and so clients, who are unable to travel, are denied services. This is particularly salient for the elderly or disabled for whom it may be difficult or detrimental to their health to travel. Individuals without their own means of transport, who may have to rely on an irregular public transport service, or the good will of friends and relatives in order to reach main health care resources, are also penalised. In-patient stays can create additional financial burdens on visiting relatives. The use of telemedicine reduces the need for travel as people can be seen in their own community, usually in their local GP surgery and sometimes even in their own home by health care workers stationed at a distant site (Gott, 1995).

1.52 Access to specialist care

Lack of specialist services is a problem in rural areas. It does not make financial sense to locate a range of specialist services in areas inhabited by only a few people, leaving rurally based individuals deprived of resources. Even if

finances were available, recruiting mental health workers to rural posts is difficult mainly due to the isolation and perceived lack of continued support and professional development away from main centres (Baer, Cukor & Coyle, 1997). Telecommunications enable isolated professionals to receive support and guidance from their urban and senior colleagues and to access resource materials for research and education purposes. It remains to be seen however, whether telemedicine is regarded as an adequate incentive for recruitment purposes.

Telemedicine has the potential to dramatically affect the availability and dispersal of health professionals' expertise. In many cases, in remote locations, nursing or junior medical staff are capable of treating the majority of medical complaints and access to a specialists opinion is only required occasionally. This expertise is easily accessed via the telelink and would lead to more nursing staff and less senior medical staff being employed at the periphery than is done currently. In rural areas, potential referrals to alternative or secondary support systems are often not acted on due to lack of access to services or available personnel. Obtaining second opinions and access to smaller groups of health professionals such as clinical psychology or speech and language therapy is possible with telemedicine.

Everyone has the right to a high quality health service. Telemedicine aims to overcome some of the barriers created by distance by making specialist services available through the use of telecommunication links. Telemedicine has the potential to make a substantial impact on the community as a whole, not just to its health, but to how health care is perceived as being delivered to rural communities where it becomes an established part of existing health care provision. People may be more likely to live in rural communities if their expectations of the level of care that can be provided are raised.

1.53 Access to wider populations

The percentage of older adults in the population is rising. The consequent increase in the prevalence of dementia and other disorders will create additional demands on health services. Telecommunications could provide an answer to reducing the pressure on existing health care resources by providing alternative options for patients which do not require large numbers of trained staff. Telemedicine has a particular advantage for older adults as it is capable of providing continuing care and information to individuals and carers in their own homes and communities. Telecomputing has been used to provide information and support to caregivers of persons with dementia (Smyth & Harris, 1993). With the use of a microcomputer and a modem, telecomputing has advantages over traditional support networks, as assistance and information can be accessed at home without the need for travel, whenever needed. This system also provides support without the need for the carer to arrange respite care when attending appointments or meetings. Although the aim of the telecomputing project is to provide an alternative resource for carers, it could potentially create further isolation for caregivers who may feel increasingly trapped within the home setting. Other systems based on direct patient care such as Remote Monitoring Telemedicine, monitors how individuals manage their activities of daily living at home by the use of magnetic, infrared and temperature sensors which then send data to the medical centre (Kron, 1995). Although such programmes aim to allow older people to remain at home as long as possible and to allow the early detection of problems, there are major concerns about individuals privacy and confidentiality which need to be addressed.

Telemedicine has a part to play in city areas where traffic congestion can make travelling between locations difficult. It has been noted that within an urban

setting many disadvantaged individuals are unwilling to travel even short distances to receive mental health services (Baer *et al.* 1997). It would therefore seem crucial to try and make services as accessible as possible. This is one of the core aims of telemedicine. The estimated prevalence of mental disorder amongst prison inmates is between seven and 15 percent, and the prison population is increasing annually. Providing an essential service to this group in an effective manner is extremely problematic (Baer *et al.* 1997). Telemedicine allows practitioners to reach populations like these for whom direct patient contact may be difficult. Other applications of telemedicine have included providing medical assistance to sailors, airline passengers and islanders (Rizzo, Fulvio, Camerucci, Carvalho, Biagini & Dauri, 1997). In these situations the use of telemedicine has helped confirm the severity of a patient's symptoms in order to provide the most suitable treatment and avoid the unneccesary cost of an emergency transfer to the mainland. It enables local staff to receive expert advice on the treatment of more complex problems and provides seafaring or airborne staff with access to immediate medical back-up. There are several situations where telemedicine is the only feasible option for providing medical care. The most obvious example would be the treatment of astronauts in space, but it could also be invaluable for providing emergency aid in war zones where it is too dangerous for medical staff to attend or for patients to be transferred out of the area.

1.54 Economics

One of the disadvantages of telecommunication equipment is the cost and many health care providers are reluctant or unable to spend large amounts of money on new systems. Despite the initial purchase of the telecommunication equipment being relatively expensive, costs are soon regained when travelling

expenses for health professionals or patients are no longer required. Joint development projects with education and business users are an alternative solution. This would alleviate the expense as well as providing additional resources for the community, but clear guidelines on administration and responsibility would need to be established. Narrow-bandwidth approaches are less expensive than broadband approaches and may be adequate for the majority of clinical purposes (Baer, Cukor, Jenike, Leahy, O'Laughlen & Coyle, 1995). Previous studies have closed down due to inadequate finances, management and technical support (Preston, 1992). For telemedicine to succeed and develop, it is important that all clinical and administration staff are properly trained, that there is adequate technical assistance and that someone has responsibility for managing the use and maintenance of the system.

With the increase in telemedicine's popularity, McLaren & Ball (1995) argue that it is not always necessary to purchase expensive telecommunications equipment and that often less expensive systems already in existence such as the telephone, are adequate for most purposes. Providers need to be clear about their aims when introducing more sophisticated telecommunication systems in order to improve services. Evidence about the benefits of telemedicine is encouraging but not established and managers need to be cautious that the glamour of new technology is not influencing their decisions. There is a need for more information about the costs and benefits of implementing telemedicine systems (Lobley, 1997), and evaluating the efficacy of telemedicine is crucial. At present most evaluations are small scale, descriptive pilot studies being conducted in an uncoordinated manner mainly by professionals who are responding to local needs or budgets. Attempts are now being made to improve communication between telemedicine sites and allow future developments to be planned in a more coordinated manner (Curry & Norris, 1997).

1.55 Confidentiality and legal issues

Telemedicine raises many legal and ethical issues which could potentially harm its development as a viable health care resource. This is particularly evident in the USA where many insurers have been unwilling to recognise and pay for treatment by telemedicine. Although to date there has been no recorded malpractice case against a clinician who has treated patients using telemedicine, it would be difficult to determine who would be ultimately liable. With telemedicine there are many more people involved than in a normal consultation; the practitioner at the remote site, the local doctor, the equipment manufacturer and the telecommunications company could all potentially be sued. One advantage of video-link consultations is that digitalized messages are far more difficult to break into than telephone lines, making it easier to ensure patient confidentiality.

There are issues being raised about the increasing use of electronic patient records surrounding what type of information is recorded, how it is recorded, who legitimately has access to patient information, how informed consent for treatment can be obtained from clients at a distance and how confidentiality can be maintained. Electronic records pose particular problems for some professions due to the sensitive nature of information exchanged between the client and the professional and the potential harm that could result from exposure of such information (Kat, 1998).The use of encrypted records and passwords for entry into files can reduce the risk of information being accessed by unauthorised individuals.

In the UK telemedicine could create funding difficulties if specialist services are being provided by professionals from different health care Trusts. A similar situation has created problems in the USA where practitioners must be licensed in the geographical area where they work, implying that if they are providing

services to different areas or countries via telemedicine then multiple licenses would be required. Wyatt (1996) expresses concern that practitioners may suffer from technology "lock-in" and that doctors may become reliant on expensive telemedicine which will reduce the range of specialists to whom they can refer. There is also the danger that once purchased, health care providers will feel obliged to use the equipment in order to justify the expense without adequately evaluating its usefulness. Conversely not treating individuals by telemedicine may be considered unethical by depriving them of resources that could reduce suffering and improve their quality of life (Darkins, 1996).

There are obviously many advantages to telemedicine i.e. being able to provide specialist services to patients in remote areas, providing education and support for professionals and increasing the quality of health care for rural communities. The disadvantages include the expense of the systems, the need for good training and technical support and an awareness of the potential confidentiality and legal complications. For telemedicine to develop as a viable process these issues must be tackled.

1.6 ACCEPTANCE OF TELEMEDICINE

Dongier *et al.*(1986) were among the first to investigate patients' satisfaction with two-way television for psychiatric consultation in a controlled study. Fifty patients received a consultation via interactive television and 35 patients in a matched control group received a face-to-face consultation. Present at all consultations were the patient, the psychiatrist and the referrer (i.e. psychologist, nurse, occupational therapist or social worker). In the teleconsultation group the

psychiatrist was at a distant site. All patients were asked to rate their satisfaction with various aspect of their consultation in relation to their previous experience of psychiatric interviews. The items were: feeling at ease during the interview; ability to express oneself; feelings after termination of the interview; perceiving the psychiatrist at ease during the interview; quality of the interpersonal relationship; helpfulness of the interview in their treatment. Consultant psychiatrists and referrers rated the usefulness of the preliminary and post-interview discussions between themselves, the patient/referrer or patient/consultant relationship, the written conclusions for diagnosis, management and treatment and the global evaluation of the usefulness of the interview. Consultants rated the teleconsultation as inferior to the face-to-face interview on all measures. Referrers also rated the teleconsultation consistently inferior to the face-to-face interview, although they felt it was "better than average" in comparison with their previous experience of psychiatric interviews. Patients were slightly more enthusiastic about the teleconsultation with the majority rating it "above average" in comparison with past experience. There was no significant difference between the two patient groups in any of the other measures.

In summary, the teleconsultation appeared to be less satisfactory for the health professional than for the patient. One major drawback of the study was that patients were not randomly assigned to the two groups and there may have been fundamental differences between patients in the groups. The authors conclude that interactive television can be an effective method of mental health care delivery, but did not provide further suggestions as to why the consultants and referrers felt it was inferior to the face-to-face interview and how this could be addressed.

Jerome (1993) describes a Canadian study using telecommunication links for child psychiatric and family assessments. A consultant child psychiatrist provided

weekly consultations with a team (consisting of a psychologist, a social worker, a psychiatric nurse and a child psychotherapist) at a remote site. Both patients and staff felt that live interviews were superior to video-link interviews although no formal assessment was conducted. The author gives details of some of the problems encountered with the telecommunications link including: an inability to focus on an individual when the general view was of the family; less hypothesis generating amongst team members than took place during on-site assessment and the teams preference for face-to-face contact with the consultant. Although a split-screen would allow both the individual and group to be viewed simultaneously, and more hypothesis generating may occur with increasing confidence of using the equipment, a lack of personal presence is the basis for using telemedicine and so for Jerome's team this would always make it second best.

Other studies have found that patients generally accept telemedicine. For example, Allen & Hayes (1994) investigated the opinions of 39 patients at a rural oncology clinic. The majority were satisfied with the telemedicine procedure although several expressed concern that it may completely replace the on-site visits.

Bloom (1996) surveyed over 30 elderly patients and found that the majority of them were happy using the telecommunication system for medical consultations. Some said that they felt more comfortable and less intimidated by the doctor using the telecommunication link than they did seeing him face-to-face and one particular advantage of the teleconsultation was the ability to take home a video tape of the interview. Individuals said that they felt involved in the teleconsultation, the specialist was focused on them and they were able to hear all discussions between their own doctor and the specialist. The author reported that good broadcast quality and a large screen added to patient satisfaction, although this was not formally assessed.

Telemedicine appears to be more acceptable to certain groups of patients than others. Over twenty years ago, Dwyer (1973) reported that patients with schizophrenia, adolescents and young children benefited most from teleconsultation, suggesting that for these individuals communication via interactive video was easier than contact in the same room. Zarate, Weinstock, Cukor, Morabito, Leahy, Burns & Baer (1997) also found that telemedicine was generally more acceptable to patients with schizophrenia than those with obsessive-compulsive disorder. Whether this is because the teleconsultation is more focused, less confrontational or the preference is related to individual personality characteristics is unclear. Although not formally assessed, Brown (1995) suggests, for obvious clinical and legal reasons, that telemedicine is not appropriate for acutely suicidal patients, patients with borderline personality disorder and patients undergoing acute substance detoxification, without the support of an on-site clinician.

Videoconferencing projects are often criticised for not including potential users' views before being put into operation (Fussell & Benimoff, 1995). The reliability of asking people's opinions on something they may not have experienced is questionable. For example, interest in telemedicine for teaching purposes was studied in a sample of three hundred medical students (Gschwendtner, Netzer, Mairinger & Mairinger, 1997). Of the third who responded to this, most students were keen for the development of telemedicine and would be willing to attend lectures via telemedicine, but difficulties in providing clear definitions of telemedicine, the lack of information on possible telemedicine applications and the lack of current opportunities for students to experience teaching by telemedicine were highlighted. In an earlier study, videoconferencing was evaluated for teaching and supervision of students at a distance. Case presentations by psychiatry students were transmitted to their tutor. Although most students and tutors viewed the experience positively, loss

of eye contact when students referred to notes which were out of camera view was reported as problematic. Tutors unable to see that students were referring to their notes may interpret looking away as a lack of confidence. A small number of people were involved in the study and different levels of anxiety and self-consciousness by students were reported. Lack of familiarity with the videoconferencing equipment and awareness that they were being videotaped for future scrutiny may have accounted for this (McLaren, Ball, Summerfield, Lipsedge & Watson, 1992).

The variability in acceptability of telemedicine is evident and there is a need for more research to investigate which groups are suited to teleconsultation and which are not. Most studies of patient satisfaction with telemedicine have been anecdotal and limited, satisfying themselves with the information that if people say they like teleconsultation then that in some way implies it is effective. Although it is crucial to include patients' views on the systems, there is also a desperate need for more controlled trials into the systems effectiveness.

1.7 COMMUNICATION THEORY AND TELEMEDICINE

Telemedicine is a process that allows people to communicate with each other at a distance. One of the main factors that affects people's acceptance of telemedicine is how they react to the lack of personal presence. For some the distance is less threatening than direct contact and aids communication; however others feel inhibited by the lack of privacy and reliance on technology.

In theoretical terms, the basic units of any communication are a sender, receiver and message set within a particular context (Ellis, Gates & Kenworthy, 1995).

The interplay of these variables gives meaning to the interaction and can be affected by a whole range of internal and external factors such as expectations, attention and concentration, previous experience, knowledge, attitude and personality, noise levels and competing messages. Telecommunications add an additional dimension to the communication process which as yet is not fully understood.

Studies of doctor-patient communications have shown that satisfaction is highly correlated with the affective and behavioural aspects of the consultation, as well as the competence of the health professional. Individuals' understanding and memory of the communication also influences their satisfaction (Ley, 1988). In psychology, the warmth and empathy of the therapist have been recognised as important factors in the outcome of therapy (Goldstein & Higginbotham, 1991). All of these factors can be affected by telecommunications.

Infante, Rancer & Womack (1997) have developed the simplistic communication model of Ellis *et al.* (1995) to include six variables: source, message, channel, receiver, noise and feedback. This provides a useful framework for investigating the effect of videoconferencing on individuals' satisfaction with the consultation, in addition to investigating the effect on the therapeutic relationship and outcome.

Alternative definitions of these variables are possible but for the purpose of this discussion they will be defined as: source (psychologist conducting the teleconsultation); message (what information the psychologist wishes to transmit; verbal and nonverbal messages, data or images); channel (the telecommunication equipment); receiver (the client at the receiving end) noise (physical, psychological or semantic) and feedback (verbal and nonverbal, positive and negative). The teleconsultation can affect the quality of the communication at any one of these stages. For example, the confidence and knowledge of the psychologist can affect the source of the communication by influencing how

credible or well prepared they are viewed by the client as being. Lack of confidence in the use of the equipment may be perceived as lack of confidence in their own ability as a psychologist, the reverse is also true. The message transmitted can be influenced by what the psychologist says, what tests or material they use, as well as their appearance, tone of voice and facial expressions. The type and sophistication of the equipment will determine how capable it is of transmitting the message. In addition weather conditions and operating expertise will affect how efficiently the equipment works. How well the message can be transmitted by technology and the psychologist along with client characteristics such as attitude and expectations will affect how well the communication is received by the client. The videoconference can be affected by outside physical noise depending on where it is positioned. Sound and picture quality of the videoconference can have an added influence on the consultation if a client is preoccupied or misinterprets what the psychologist says. This could be falsely attributed to difficulties with the sound or lack of personal presence. Feedback is important in knowing whether the message has been received and understood. Time delay and lack of clarity in facial expression can interfere with verbal feedback and limit the usefulness of nonverbal feedback .

Establishing rapport depends heavily on non-verbal cues and two aspects of non-verbal communication which are especially changed by teleconferencing are eye gaze and gesture (Fussell & Benimoff, 1995). The position and angle of the camera will affect what view the psychologist and client receive of each other. For example, a large field of view will allow individuals to view body language and gestures but will compromise clarity of facial expressions. Direct eye gaze is not possible when the camera is mounted above the screen as in most videoconferencing units. This can add to the 'distant' feeling created by the teleconsultation (Muhlbach, Bocker & Prussog, 1995). Other limitations of telemedicine in the communication process are the inability to touch and the delay

of one or two seconds between a sender speaking and the message being received. This can interfere with appropriate turn-taking in a conversation and may affect rapport building, particularly at the start of a session.

Good communication is essential for health care professionals to be confident in their assessment and treatment programmes, and for clients to be satisfied with the consultation. The limitations of communication via telemedicine creates one of the major barriers to the acceptance of telemedicine by many professionals. Possible solutions include alternating face-to-face consultations with teleconsultations or to have another local health worker assisting with the consultation at the other end, although this could potentially create further communication difficulties if the health worker was inexperienced, or was unable to describe non specific symptoms in a manner that could be universally understood.

Telecommunications can enhance clients' satisfaction with consultations in several ways: by increasing the contact between client and therapist and allowing for more frequent review of treatment goals; by enabling clients to ask more questions in a less threatening environment where there is less of a power imbalance between the professional and the client; and by enhancing memory and understanding of information by allowing the recording of consultations for review between sessions.

Although it is possible to overcome many of the communication problems created by telemedicine with the use of more sophisticated technology (e.g. by improving the image and sound quality), there is a need for further research into the effects of telemedicine on non-specific factors which contribute substantially to the quality of the therapeutic relationship and effectiveness of treatment.

1.8 COGNITIVE ASSESSMENT VIA TELECOMMUNICATION LINKS

Since the first early trials, psychiatry and telemedicine have been successfully linked; however most of the studies to date have been descriptive studies of psychiatric consultations. There is increasing evidence, particularly from geriatric psychiatry, that telemedicine can be successfully used for carrying out cognitive assessment and the aim of the current study is to add to this knowledge base by investigating the use of telemedicine in the administration of cognitive assessments with a clinical sample.

The general use of telecommunications in mental health has been well recorded. The telephone, in particular is widely used by mental health professionals and has been shown to be a reliable method of assessing cognitive functioning in clinical groups (Ball & McLaren, 1997). Although in many situations the telephone provides a sufficient medium for consultations, interactive television has been shown to have many advantages over the telephone in clinical assessment including the ability to assess a wider range of cognitive abilities than is possible using the telephone such as praxis and visuospatial functioning (Ball & McLaren, 1997). The handful of studies that have been carried out with videoconferencing have produced encouraging results justifying further investigation.

Ball, Scott, McLaren & Watson (1993) used the Mini-Mental State Examination (MMSE) in a study comparing face-to-face interviews with interviews using a Low-Cost VideoConferencing (LCVC) system in an adult psychiatric population. The MMSE consists of 30 items assessing cognitive functioning. All participants were tested under both conditions within 48 hours and the order

of testing was randomly allocated. They found a high correlation (r=0.89-0.92) in client's MMSE scores given face-to-face and via LCVC and concluded that the MMSE, with minor modifications (i.e. asking patients to hold a piece of paper up to the camera after writing a sentence on it, and asking patients to place a piece of paper on their head as opposed to on the floor where it could not be seen) could reliably be carried out using the LCVC. This study was limited due to its small sample size (11) and due to using only the MMSE which is not a comprehensive cognitive assessment but a screening test to be followed up by further investigation. The authors recognise these limitations and highlight the need for more research using a wider range of assessments in different client groups.

The MMSE and Clock Face Test (CFT is a simple measure of cognitive and visuospatial ability) have been used in other studies (Montani, Billaud, Tyrrell, Fluchaire, Malterre, Lauvernay, Couturier & Franco, 1997). In this study 15 hospitalised elderly patients were assessed under both conditions, 8 days apart. Correlations between face-to-face and video-link presentations were high on the MMSE (r=0.95) but lower on the CFT (r=0.55). Differences were found with MMSE scores being significantly lower via video-link than in face-to-face consultation. No significant differences were found for the CFT although individuals' performance was found to be less consistent on this test. Video consultations were significantly shorter than standard face-to-face consultations and the majority of elderly people who participated said that they preferred a face-to-face interview. The clinical psychologist had the advantage of technology which allowed them to focus on the patient and then move the camera using a remote control to focus on the test to allow scoring, but the lack of direct eye contact due to the angle of the camera in addition to poor sound quality was felt to have a negative effect on the consultation.

Videoconferencing has particular appeal for the assessment of cognitive function in elderly patients. There is a lack of clinical psychologists specialising in older adult client groups and often it is undesirable for the patient to have to travel long distances to be seen. Ball & Puffet (1997) found that the CAMCOG test (an assessment of memory, praxis, perception, abstract thought, calculation, orientation, language and concentration) was reliable by videoconferencing at 128kbits although it was necessary to have a local assistant to present some of the material. There was a slight increase in the relationship between face-to-face and videoconferencing scores when material was re-presented by the local assistant (from r=0.72 to 0.75). This indicates that presentation of this material via the video-link alone, without the assistant was inferior . Lower correlations were found on the calculation (0.10) and abstract thought (0.41) subtests than any of the other subtests; potential reasons for this discrepancy are not clear. Caution must be taken in interpreting the generalisability of the results as only eight elderly patients were assessed under both conditions.

Fifteen elderly patients with no known cognitive deficits and 10 elderly patients with dementia were assessed face-to-face and via telecommunication links using the MMSE and the Clock Face Test (Montani, Klientovsky, Tyrell, Ploton, Couturier & Franco, 1997). There was no difference in scores for the demented patients between the two mediums and they appeared more at ease with the video-link than the non-demented patients. Non-demented patients scored significantly lower in the teleconsultation interview for which no explanation is given. For demented patients the teleconsultation was reliable, but for non-demented patients there was a significant difference in ratings of their performance. It is not known whether this was caused by patient factors such as anxiety, inconsistencies between raters or technical difficulties.

Other studies have looked at the use of telecommunications with specific client groups. Baer *et al.* (1995) investigated the reliability of rating scales for

obsessive-compulsive, depression, and anxiety symptoms, administered face-to-face (n=16) and over a narrow-bandwidth video-link (n=10) to patients with obsessive compulsive disorder. Two raters simultaneously rated clients, one sitting with the client at the remote site, whilst the client was being asked questions by the other rater over the video-link. In the face-to-face interview both raters sat with the client in the same room. High interrater reliability was reported for the Yale-Brown Obsessive Compulsive Scale, the Hamilton Depression Rating Scale and the Hamilton Anxiety Rating Scale . Both patients and raters felt that the teleconsultation was "average" or "better than average" with regards to comfort levels, ability to express themselves, helpfulness and usefulness. The authors conclude that the video-link is useful and reliable in the administration of semi-structured rating scales for obsessive-compulsive, depressive, and anxiety symptoms in patients with obsessive-compulsive disorder and that this is possible using low-cost narrow-bandwidth transmission. In this study the second rater was present in the same room as the patient for both face-to-face and teleconsultation interviews. Although for some procedures it is necessary to have a local health worker to assist in the consultation, to the author's knowledge, there has been no research to date on the effect of the presence of a local assistant on the outcome of the teleconsultation. This study also found that although increasing the bandwidth (to 384 kbits) increased the image quality, reliable assessment could be carried out using the lower bandwidth of 128 kbits.

Zarate *et al.* (1997) assessed the reliability of teleconsultation in the assessment of patients with schizophrenia. Using the Brief Psychiatric Rating Scale (BPRS), Scale for the Assessment of Positive Symptoms (SAPS) and the Scale for the Assessment of Negative Symptom (SANS) they interviewed three groups of 15 patients under three different conditions: in person; using low bandwidth videoconferencing equipment; and using high bandwidth videoconferencing

equipment. They found that the BPRS and the SAPS were assessed equally reliably by all three methods (intraclass correlations). Overall, both low and high bandwidth were less reliable than the face-to-face method, but equally reliable on the total BPRS ('live' 0.96; 'low' 0.84; 'high' 0.90) and SAPS ratings ('live' 0.94; 'low' 0.97; 'high' 0.97). The SANS was slightly less reliably assessed at the low bandwidth, as were several specific negative symptoms of schizophrenia that depend heavily on nonverbal cues ('live' 0.92; 'low' 0.67; 'high' 0.85). It was suggested that this was due to misinterpretation of "shadowy echoes" that can appear when the patient moves as being caused by motor slowing rather than being caused by an unavoidable feature of the low bandwidth equipment. In general, teleconsultation was accepted by patients, however those in the high bandwidth group were more likely to prefer the teleconsultation to a face-to-face interview. No suggestions were given as to why this was found, although as was noted previously, it is possible that the personal distance created by using the equipment was less threatening and therefore more attractive to the patients. Also the better quality picture of the high bandwidth may have been less frustrating for them than the low bandwidth which can produce some jerkiness and blurring after a sudden movement which can take several seconds to stabilise. Although the results of this study suggest validity of cognitive assessment via telecommunication links in a sample of patients previously diagnosed with schizophrenia, the authors comment on the need for research where a previous diagnosis has not been established.

Salzman, Orvin, Hanson & Kalinowski (1996) found high inter-rater reliability on the BPRS via telecommunication links in a small sample of six psychotic hospital in-patients (r 0.92). They also found that the assessment of negative symptoms was less reliable than the assessment of other symptoms over the video-link, although exact results were not given. Patients self-care could not

be adequately observed which led to some disagreement on the rating of self-neglect. Unfortunately no details of the equipment were given.

1.81 Assessment and treatment studies

Two innovative programmes which offer assessment and treatment of psychological disorders via telecommunication links have been developed.

An interactive computer-administered behaviour therapy programme has been effective in the treatment of individuals with obsessive-compulsive disorder (Baer & Greist, 1997). In this study 65 individuals followed a self-assessment and self-help programme using a computer programme which was accessed via a free phone number using domestic touch-tone telephone (BT STEPS). The programme consisted of nine steps which addressed the major features of behaviour therapy i.e. education, behavioural assessment, treatment planning, treatment and relapse prevention. Interactive voice response (IVR) allows a computer to send digitized voice files over standard telephone lines to the patient who can then respond to questions by pressing keys on their touch-tone telephone. In addition to listening and responding to standard files individuals are able to leave personal messages on aspects of the treatment for a behaviour therapist who then leaves the client a recorded response. Most patients who completed at least two or more exposure and response prevention sessions improved as a result of contacting the computer programme. The average length of call was eight minutes with a total contact time of seven hours and 58 minutes. As the majority of people have a telephone in their own home, this programme has the advantage of being accessible to a wide range of people, it is low in therapist time and therefore inexpensive and clients are in control of their own

therapy. The programme was seen as being as effective as drug therapy although no control group was included. There was also no follow up on patients who dropped out or who were not progressing with treatment. To reduce the attrition rate an initial assessment by a trained therapist to help the patient identify triggers, plan treatment goals or explore contributing factors may be necessary for some clients.

Lange, Emmelkamp & Bredeweg (1998) are conducting a pilot study into the treatment of post-traumatic stress disorder via the Internet. Using standardised and evaluated protocols, clients send in writing assignments by e-mail and receive feedback from trained therapists. To be accepted into the treatment programme, clients must meet the inclusion criteria on diagnostic tests completed on the Internet, which are scored and interpreted automatically. Advantages of the programme include being able to access treatment and complete writing assignments at any time. Therapists can also be more flexible about when they send instructions and feedback. No results are yet available from the pilot study, although it is hoped to expand the project to provide treatment for eating disorders and marital problems. The authors emphasise the need for careful screening procedures and only using treatment protocols which have been carefully evaluated in face-to-face situations. This programme has advantages over videoconferencing including being able to reach more people and being less expensive. The lack of visual communication may be an issue as will maintaining the confidentiality of any material sent.

1.9 SUMMARY

The studies on cognitive assessment via telecommunication links carried out to date have been limited in several ways. Generally they have involved small numbers of participants and used the same tests via both mediums. Repeating the same tests with participants increases the risk of practice effects caused by familiarity with the material, although this is less likely with dementing individuals whose cognitive deterioration may prevent any significant learning taking place. Practice effects would bias results by inflating the correlations on face-to-face versus telelink performance. A small range of cognitive assessments have been used in the studies, in particular the MMSE which is not widely used by clinical psychologists. The majority of videoconferencing equipment used has been narrow bandwidth, with the sound and picture quality limitations this entails. However, this has been found to be adequate in most cases cited here.

Despite the lack of controlled studies, there is enough evidence that cognitive assessment via telecommunication links is sufficiently reliable, with recognised client groups and with certain types of assessments, to warrant further investigation. Whether it is useful for first time assessment or diagnosis has yet to be determined. Assessment via telecommunication links requires a degree of flexibility in presentation although it is worthwhile persisting in using off the shelf standardised assessments with which practitioners are familiar, if telemedicine is to develop and become a valued part of everyday clinical practice (Ball *et al.* 1993). The use of standardised assessments with parallel forms reduces the risk of practice effects and the author is not aware of any previous telemedicine studies which have used parallel forms of cognitive assessments with a larger group of participants in a controlled trial. This project aims to expand on previous research by assessing the validity of

standard intellectual, memory and concentration tests used in clinical psychology. The generalisability of previous results will also be considered by focusing this study on clients with a history of alcohol abuse. Alcohol related problems create a large number of referrals to Clinical Psychology and to the author's knowledge they have not been included in previous telemedicine studies as a distinct group.

1.10 TELEMEDICINE IN THE HIGHLANDS

The Highlands of Scotland, with a population of approximately 210,000, has one of the lowest population densities in Europe with approximately eight people per square kilometre. This poses enormous problems when planning health service delivery and makes it an ideal location for the development of a telemedicine service. Inverness is the most densely populated area in the Highlands and is where the main hospitals and health services, including the Clinical Psychology department are based. The Clinical Psychology Department is responsible for providing psychological services to a vast geographical area of over 25,000 sq kms - from Wick in the north to Fort William in the south, Nairn in the east and Skye in the west. Since May 1996 the Clinical Psychology Department has operated a telemedicine service between Inverness and Skye in an attempt to improve the psychological service to individuals in remote areas. Preliminary evaluation seems to suggest that it is well received by patients although there were some criticisms about sound and picture quality (Freir, Kirkwood, Robertson, Scott-Lodge, Peck & Zeffert (submitted, 1998)).

1.11 BACKGROUND TO THE STUDY

At present the majority of individuals requiring clinical psychology services have to travel to Inverness. The telemedicine service has created a potential solution to this problem but it is still in an early stage of development and requires further evaluation. Cognitive assessment is an important feature of Clinical Psychology work, and although preliminary evidence suggests that telemedicine can be used reliably for cognitive assessment (Ball & McLaren, 1997), there is insufficient evidence from controlled trials to implement such a service in the Highlands without further research. Within this framework, the aim of this study is to investigate the validity of cognitive assessments presented over telecommunication links in a clinical sample.

1.12 AIM AND HYPOTHESIS

Aim:

To investigate the validity of cognitive assessments presented over telecommunication links in a clinical sample.

Research hypothesis:

Given the evidence from previous studies, the research hypothesis states that there will be no significant differences in the outcome measures of cognitive assessments presented via telecommunication links and those presented via face-to-face (i.e. the null hypothesis).

Main research questions:

1. What aspects of cognitive assessments are affected by video-link transmission ?

2. How acceptable is cognitive assessment via telemedicine to the client ?

CHAPTER 2 METHOD

2.1 PARTICIPANT RECRUITMENT

The researcher contacted the following individuals and organisations in order to recruit volunteers with a history of alcohol abuse: a residential rehabilitation centre, an alcohol and drug day centre, a mental health day hospital, a psychiatric in-patient ward, community psychiatric nurses, a clinical psychology department, a hostel for homeless people and a drop-in centre. Twenty-one letters were also sent out to individuals who had taken part in a previous alcohol study for the Highland Psychiatric Research Group.

The only criterion that was required was that individuals had a history of alcohol abuse. No limits were set as to the degree of severity of problem, length of alcohol abuse or length of abstinence. Although it was hypothesised that no significant differences would be found between teleconsultation and face-to-face interviews, if there were to be large differences, a minimum of 25 participants would be required to perform the necessary statistical analysis (power=0.80, $p<0.05$, large effect size).

The researcher made initial contact with these organisations to explain the aims of the project. In order to maintain confidentiality potential participants were initially approached by staff members. If they wished to take part in the project their names were then passed on to the researcher.

The researcher made contact with participants either by telephone, letter or in person. All participants were given an information leaflet outlining the

objectives of the project and their involvement. They were then asked to sign a consent form and answer some questions on their age, marital status, education level, current and previous employment status, drinking history, medication and any illnesses or disabilities. An appointment was then arranged for them to attend the hospital where the teleconsultation equipment was installed. All participants received travelling expenses for attending. A copy of the information sheet is included in appendix 1.

2.2 THE TELECOMMUNICATIONS EQUIPMENT

The equipment consisted of two British Telecom VC7000 videoconferencing machines (using ISDN2 links with a transmission speed of 128 kbt/s) and a Panasonic WE-160 video-imager.

The monitor used by participants was in a room in the Clinical Psychology Department within the hospital. The second monitor used by the researcher was on loan from the Health Board and was in the Health Board building approximately six miles away. After the first interview, the researcher had a drive of approximately 15 minutes between the two sites. The teleconsultation equipment and video-imager are shown in figures 1-3.

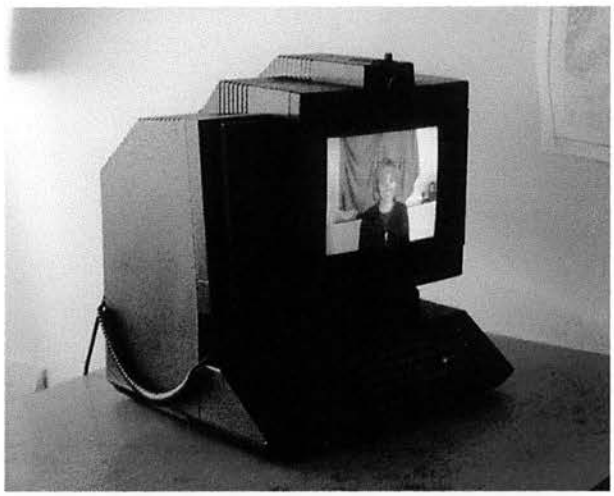


Figure 1:
The Videoconferencing System.

The interviewer as viewed by the participant.

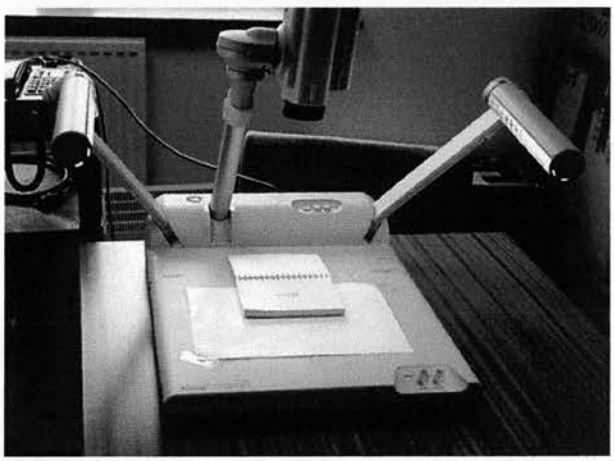


Figure 2:
The Video Imager.

Presentation of the NART using the video imager.

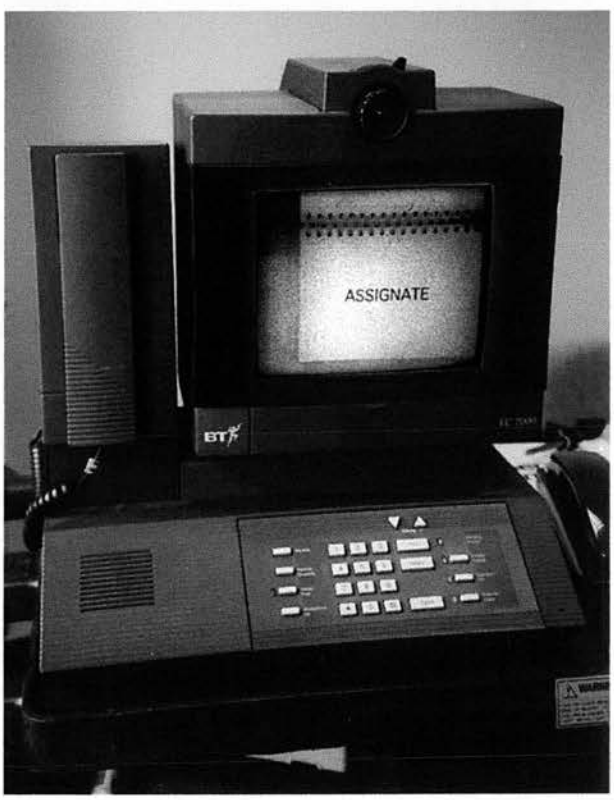


Figure 3:
Assessment Presentation.

The NART as viewed by the participant.

2.3 INTERVIEWS

All participants completed both a face-to-face interview and a teleconsultation interview with the same researcher. Half of the participants were given the face-to-face interview first and half were given the teleconsultation interview first. Most interviews took between 30-50 minutes to complete and there was a break of approximately 30 minutes between the two interviews. This gave the researcher time to travel across town to the second site and also gave the participant a break from the assessments. Hot drinks were available for participants during the break.

2.4 COGNITIVE ASSESSMENTS

The assessments used were chosen to cover main areas of functioning commonly assessed in clinical practice, i.e. premorbid and current intellectual functioning, verbal memory, visual memory and attention/concentration. The tests were also chosen because they had two parallel forms (excluding the test of premorbid intellectual functioning).

The main assessments used were: the National Adult Reading Test (NART) (Nelson, 1982); the Quick Test (Ammons & Ammons, 1962); and the Adult Memory and Information Processing Battery (AMIPB) (Coughlan & Hollows, 1985). Details of these are given in sections 2.41 to 2.43.

2.41 The Adult Memory and Information Processing Battery (AMIPB)

This battery consists of two tests of verbal memory, two tests of visual memory and two tests of information processing, all of which have parallel forms. This battery was used as participants could be given parallel forms of the same tests under the two interview conditions.

Two subtests from the AMIPB were not used in the final project: Information Processing B and Design Learning. These were omitted for three main reasons:

i) Information Processing B is a test of concentration/attention and does not appear to add any significant information to the results obtained for Information Processing A which was used as it is a more sensitive test of impairment (Coughlan & Hollows, 1985)

ii) Design Learning is intended as a visual equivalent of the verbal List Learning task. The test requires the participant to copy a design until it is correctly recalled on two occasions or until it has been copied five times whichever is sooner. In order to do this over the telelink the participant had to use a thick black pen and hold the resulting design up to the camera. The clarity of the design was felt to be unsatisfactory as the researcher could not always be certain that the person had correctly copied the design.

iii) Overall it was felt that including these two tests made the interview excessively long, particularly as the participant had to repeat the process

twice. The variation in test administration (i.e. using a thick black pen and holding the picture up to the screen) also made the test potentially unreliable.

Although it was not possible to directly observe clients completing the Figure Recall and Information Processing A tests over the video-link, the pilot study provided sufficient evidence to suggest that it was possible to assess clients despite this limitation.

The following subtests from the AMIPB were used in the project:

a) Story Recall (Forms 1 and 2)

This test of verbal memory requires the immediate recall and delayed recall (after 27-33 minutes) of a short prose passage. Age-related norms are provided for form 1 and 2 for: immediate recall (actual score); delayed recall (actual score) and retained (delayed/immediate score expressed as a percentage).

b) List Learning (Forms 1 and 2)

This is a test of verbal memory and assesses an individual's ability to learn new material. Individuals are read a list of 15 words after which they have to recall as many of the words as possible in any order. This is repeated five times or until the individual correctly recalls all 15 words on two occasions. This is followed by asking the individual to recall as many words as they can from an interference list of a different 15 words which is read once. After this they are

again asked how many words they can recall from the first list to assess any affect of being given the interference list. Age-related norms are provided for each form for : total (total number of words recalled in trials one to five); B (the number of words recalled from a second distracter list) (B); A6 (the number of words recalled from the original list after list B) and intrusions (the number of intrusion words in trials one to five).

c) Figure Recall (Forms 1 and 2)

In this test of visual memory individuals are shown a two dimensional line diagram which they are asked to copy. They are told to try and memorise it as they copy it as they will be asked to draw it from memory later. Immediately after they have completed copying it the diagram is removed and they are asked to draw as much of it as they can from memory. After 27-33 minutes delayed recall is assessed and they are asked to try and draw as much of the diagram as they can remember. Age related norms for both forms are provided for: copy (copy score/maximum possible, expressed as a percentage); immediate recall (immediate score/copy score expressed as a percentage); delayed recall (delayed score/copy score expressed as a percentage) and retained (delayed score/copy score expressed as a percentage).

d) Information Processing A (Forms 1 and 2)

This test has two parts and assesses an individual's ability to perform a repetitive task which requires a degree of concentration and attention. In the first task individuals are given the instruction to cancel out the second highest number in a line of five numbers. They are then given four minutes to cancel

out as many numbers as possible. They are given five practice attempts before beginning.

e.g:	35	24	13	26	48	(score out 35)
	89	41	55	20	37	(score out 55)

The second part of Information Processing A is a test of motor speed. Individuals are given 20 seconds to score out as many items (number 11's presented in columns) as possible. Age related norms for forms 1 and 2 are provided for: total (total number scored); speed (total number scored on motor speed test); errors (number of errors/total score expressed as a percentage) and adjusted score (derived from total and speed scores).

2.42 The National Adult Reading Test (NART)

This test was included as a measure of an individuals' premorbid intelligence. Individuals are asked to read out 50 "irregular" words which do not conform to normal grapheme-phoneme correspondence rules. These words can therefore only be pronounced correctly if the person has prior knowledge of them and recognises them in their written form. The total number of errors is then converted to an IQ score.

2.43 The Quick Test

This test is widely used in research as a measure of an individual's current intelligence level and has three parallel forms. Four black and white pictures are shown to the individual who is then asked to say which picture best fits a list of 50 words, which are read out by the researcher. Forms 1 and 3 were used in the project as they were identified in the pilot study as the most clearly visible over the telelink. The total number of words correct is then converted to an IQ score.

2.5 SATISFACTION QUESTIONNAIRE

All participants were asked to complete a questionnaire at the end of the sessions to assess their opinion of using the teleconsultation equipment. Using visual analogue scales, participants were asked to rate the sound and picture quality, how easy they felt it was to communicate with the investigator and overall how comfortable they felt using the teleconsultation equipment. Responses were given by circling the appropriate number on a ten point scale. They were also asked whether they would use the television link again and what they considered to be the best and worst features of assessment via telecommunication links. A copy of the satisfaction questionnaire is included in appendix 2.

2.6 INTERVIEW PRESENTATION

As there were two alternative interview presentations (i.e. teleconsultation and face-to-face) and two alternative forms of test (i.e. form 1 and form 2) participants were randomly assigned to one of four groups to balance any order of presentation effect.

Group 1	Teleconsultation first	Form 1 assessments
	Face-to-face second	Form 2 assessments
Group 2	Teleconsultation first	Form 2 assessments
	Face-to-face second	Form 1 assessments

Group 3	Face-to-face first	Form 1 assessments
	Teleconsultation second	Form 2 assessments
Group 4	Face-to-face first	Form 2 assessments
	Teleconsultation second	Form 1 assessments

Form 1 assessments comprised of: Information Processing A form 1, Story Recall form 1, List Learning form 1, Figure Recall figure 1, NART, Quick Test form 1.

Form 2 assessments comprised of: Information Processing A form 2, Story Recall form 2, List Learning form 2, Figure Recall figure 2, NART, Quick Test form 3.

The order of presentation of these tests within interviews was randomly allocated to provide the participant with some variety between verbal and performance tasks. Due to the delayed recall of the Story Recall and Figure Recall subtests these were always given towards the start of the interview. The NART was repeated in its complete form in both the face-to-face and teleconsultation interviews as there was no evidence to suggest that an individual's performance on the test would be affected by practice effects (Crawford, Parker, Stewart, Besson & De Lacey, 1989).

2.7 TELECONSULTATION INTERVIEWS

In contrast to the face-to-face interview format used in normal clinical practice the teleconsultation interviews required several adaptations to the assessment procedure.

Participants were asked to sit in front of the TV monitor, which was placed on a fairly large table allowing adequate room for the participant to complete the tasks. A small tape recorder was placed to the side of the monitor which participants were asked to switch on at the start of the interview. The TV monitor was switched on by the researcher prior to the interview and participants were not required to touch any of the controls on the monitor unless the volume or brightness needed adjusting. Instructions on how to do this were given by the researcher as required.

The video-imager was positioned at the researcher's site and allowed her to present material over the telelink to the participant i.e. the NART, the Quick Test, the Figure Recall and demonstration items from the Information Processing A Test. (Figures 2 and 3 show the use of the video-imager for presentation of the NART).

The participant had three A4 size envelopes (numbered 1,2 & 3) on the table in front of them and some pencils. Envelope one contained three sheets of blank paper (numbered) for the Figure Recall test, the second contained the Information Processing A form and the third contained the Satisfaction Questionnaire (only for participants who had the teleconsultation interview second - individuals who had the teleconsultation first completed this questionnaire at the end of the face-to-face interview).

The researcher then asked the participant to take the appropriate form from a numbered envelope as required. A typical instruction in the Figure Recall test might be, for example:

> *Please can you take the three sheets of blank paper out of envelope 1, put the sheet with the number 1 in the corner of it in front of you*

and the other two sheets to the side. I am going to show you a diagram. Can you please copy this diagram and as you copy it try and memorise it as I will ask you to draw it from memory later.

The figure would then be placed on the video-imager so that it was visible on the participants screen. After they had completed the task they would then be asked to return the sheet to the appropriate envelope before continuing with the next task.

2.8 PILOT STUDY

Three colleagues from the Clinical Psychology Department participated in the pilot study of the teleconsultation equipment. They completed all assessments from the AMIPB, the NART and the Quick Test via the telelink. Results from this pilot study were used to adapt the presentation of assessments as detailed in the next section.

2.9 MODIFICATIONS TO ASSESSMENTS AND PRESENTATION OF INTERVIEWS USING THE TELELINK.

1. Audio tape recording of sessions - interviews were initially taped by the researcher at at her site; however, the quality of recording was not always

adequate to hear the participants' voice clearly. This was resolved by placing the recorder at the participants end and asking participants to switch the tape recorder on at the start of the teleconsultation interview.

2. NART - it was necessary to use the large print booklet as the word card used in normal practice could not be seen clearly over the telelink.

3. Figure Recall - the sheets of blank paper were numbered in advance to enable the researcher to correctly identify the copy, immediate and delayed recall diagrams when scoring later. Participants were also requested to put only one sheet of paper in front of them at a time to prevent the imprint of the previous diagram being seen on the sheet below.

4. There was initial confusion between Figure Recall and Design Learning when participants were asked at the end of the interview to recall as much of the figure as they could. It was also not possible to see the participant's responses to the design learning task over the telelink using ordinary pencil. This was improved by using a thick black pen, however this test was eventually omitted from the project for reasons given earlier.

5. The investigator demonstrated the practice items of the Information Processing A task over the telelink. Using only verbal instructions to describe to participants how to complete the task caused some confusion and further clarification was needed.

6. It was necessary to make sure the light was always on in the teleconsultation room to allow for a clear picture. Clear instructions on altering brightness were necessary as this was highlighted in the pilot study by the researcher as the most frequently changing aspect of the picture.

7. Individuals in the pilot study reported that the delay between the visual presentation and the sound was slightly disconcerting and so participants were told of this prior to their interview.

8. Any movement created blurriness or a 'tiling effect' i.e. the picture appeared to move in slow motion . This affected the presentation of diagrams and pictures on the video-imager which took a few seconds to settle, it was therefore important to keep unnecessary movement to a minimum.

2.10 STATISTICAL ANALYSIS

Statistical analyses were carried out using the Minitab statistical package (Release 10.51). The main inferential tests used were paired t-test, two way analysis of variance, correlation and Fisher's Exact Test.

2.11 INTER-RATER RELIABILITY

All face-to-face and teleconsultation interviews were audio taped. A random sample of ten face-to-face and ten teleconsultation audiotapes were chosen for the reliability study. The NART, list learning and story recall tests were re-rated by a graduate psychologist who was blind to the method of interview presentation. Reliability was found to be satisfactory on all scales (r varying from +0.82 to +1.00, $p<0.05$).

CHAPTER 3 RESULTS

3.1 RESPONSE RATE

A total of 37 people initially agreed to participate in the project. Thirty four were identified through the various organisations and individuals previously listed and 6 responded to the letters sent by the Highland Psychiatric Research Group of whom three agreed to take part.

There were six cancellations. Five were offered another appointment of whom three refused and two accepted but then failed to attend. The sixth person had cancelled because he had started drinking again and did not feel that he was able to take part in the study. Three people did not attend and could not be contacted to be offered another appointment.Three sessions had to be rescheduled due to equipment failure. One session was interrupted by bad weather affecting the quality of transmission.

Two interviews were cut short, one because the individual had to leave to attend a hospital appointment, the other because the participant was arrested by the police after the face-to-face interview and was not subsequently available to complete the teleconsultation interview. None of his data is therefore included in the final analysis.

In summary, a total of 26 individuals completed both face-to-face and teleconsultation interviews in their complete forms. Thirteen participants received a teleconsultation first, of whom six received form 1 and seven received form 2

first. Thirteen participants received a face-to-face interview first, of whom seven received form 1 and six received form 2 first, as illustrated in table 1.

Table 1. Order of interview and assessment presentation

		First assessment	
		Form 1	Form 2
First interview	Teleconsultation	6	7
	Face-to-face	7	6

One individual, who received a teleconsultation first, completed only the Quick Test by both mediums. Demographic information is presented for the total 27 participants.

3.11 Statistical power

The final number of participants was sufficient for the necessary statistical analyses and the detection of a large effect size.

3.2 METHOD OF ANALYSES

3.21 Demographic information

Descriptive statistics were used in the analysis of demographic information and drinking history. Participants had been randomly allocated to one of four groups. To assess the random distribution of participants between the groups with regard to demographic variables and severity of drinking history Fisher's Exact Test was used for the categorical variables and two way analysis of variance was used for the interval data.

3.22 Performance on assessments

Descriptive statistics were used to describe participants performance on the assessments given in the standard manner i.e., face-to-face. Performances on the AMIPB were shown in relation to age related norms. Although not directly related to the hypothesis, it was considered worthwhile to include these results as they illustrate participants level of functioning and representativeness as a clinical sample

3.23 Teleconsultation versus face-to-face

Random allocation to groups was carried out to counterbalance the effects of any differences between assessment performances due to varying degrees of difficulty between the parallel forms of the tests or due to whether they received a teleconsultation first or second. Two-way analysis of variance was

used to assess the effect of these two within subject factors on assessment results. To assess whether cognitive assessments could be performed reliably via video-link the consistency of participants scores on the teleconsultation and face-to-face assessment was investigated using Pearson product-moment correlation coefficients. The difference between assessment scores via the two mediums was assessed using paired t-tests as each participant had been assessed under both conditions.

3.24 Significance levels

The use of multiple comparisons between variables increased the chance of a Type I error. The Bonferroni Test was used to adjust the significance level for the multiple comparisons used in order to reduce the chance of accepting a significant result that was false. This test provides a conservative estimate of significance based on the number of variables in the comparison and is considered unsuitable for comparing large numbers of groups. With the number of multiple comparisons carried out in the present study, including them all in the adjustment would mean that no significant results would be found. Adjustments were therefore made according to the number of comparisons made within each test, for example an adjusted significance level of $p<0.025$ using the Bonferroni Test would be considered more appropriate for Story Recall which has two variables (immediate and delayed recall) than an adjusted significance level of $p<0.001$ calculated by including all comparisons.

3.3 DEMOGRAPHIC INFORMATION

The average age of participants was 46 years (SD 9.46, range 25-70 years) and the majority were male (20). Most had left school by the age of 17 (average years of education 11.5 years, SD 1.93, range 9-18 years) and were currently unemployed and looking for work (11) or unable to work (10). Participants were asked for details on their previous employment history. Individuals' highest level of employment achieved was rated according to the Standard Occupational Classification (Employment Dept., 1990). Demographic details are presented in Table 2.

Table 2. Demographic information

		N	%
sex	male	**20**	*74*
	female	**7**	*26*
marital status	divorced	**10**	*37*
	single	**8**	*30*
	separated	**4**	*15*
	married	**3**	*11*
	widowed	**2**	*7*
Current employment	unemployed/looking for work	**11**	*41*
	sick/unable to work	**10**	*37*
	paid employment (Groups 3,4 & 6)	**3**	*11*
	retired	**3**	*11*
Previous employment	Group 6 (Personal & Protective Services)	**9**	*33*
	Group 5 (Craft & Related)	**5**	*19*
	Group 3 (Assoc.Professional & Technical)	**4**	*5*
	Group 8 (Plant & Machine Operatives)	**2**	*7*
	Group 9 (Other Occupations)	**2**	*7*
	Group 4 (Clerical & Secretarial)	**2**	*7*
	Group 7 (Sales Occupations)	**1**	*4*
	Group 1 (Managers & Administrators)	**1**	*4*
	Group 2 (Professional)	**1**	*4*

The majority of participants had previously worked in personal and protective services (9), five had worked in craft and craft-related occupations and four had worked in associated professional and technical services. As most individuals were currently unemployed, social class based on previous occupational category is presented in table 3 (Employment Dept., 1991).

Table 3. Social class based on occupational categories

Social Class	Occupational Categories		N	%
III	skilled occupations	(M) manual	**8**	*30*
		(N) non-manual	**7**	*26*
IV	partly skilled occupations		**6**	*22*
II	managerial & technical		**5**	*18*
V	unskilled occupations		**1**	*4*
I	professional		**0**	*0*

The majority of participants (15) were in Social Class III. Of the three individuals currently in employment one was in Social Class II and two were in Social Class III.

3.4 DRINKING HISTORY

Participants were asked for details of their drinking history. Most reported that they used to drink everyday (19) and eight described themselves as binge drinkers. The length of abstinence prior to assessment ranged from 7 - 913 days (mean 105 days, SD 185). Details of participants' drinking history are presented in table 4.

Table 4. Details of drinking history

	mean	SD	range	median
length of time abstinent (in days)	104	185	7-913	28
length of time drinking (in years)	15	9	2-30	17
amount of alcohol consumed (in units per day)	39	15	7-60	38

Details of prescribed medication and any disabilities or illnesses were requested from all participants prior to assessment. Sixteen individuals were taking medication, of whom the majority were using antidepressants (11). Other medication taken included: Benzodiazepines (4), painkillers (5), anticonvulsants (1) and Antabuse (1). Eight participants had previously experienced a head injury (leading to a hospital admission and/or a period of unconsciousness), three people suffered from a hearing impairment, one person had epilepsy, one had suffered a stroke and one had a speech impediment.

3.5 COMPARISONS BETWEEN GROUPS

The distribution of participants with regard to age, years of education, time abstinent from drinking, duration of drinking history, and average daily intake of alcohol between the groups (ie. teleconsultation first or second and form 1 or form 2) was investigated using two-way analyses of variance. The results are shown in table 5.

Table 5. Distribution of participants between groups: interval variables

	telelink		form		telelink*form	
	F	P value	F	P value	F	P value
age	0.39	0.536	0.00	0.998	0.07	0.800
education	3.94	0.059	1.62	0.216	0.44	0.515
time abstinence	1.66	0.210	1.00	0.327	1.32	0.263
duration of drinking	0.58	0.456	0.00	0.982	0.09	0.772
amount of alcohol	1.15	0.295	0.38	0.542	2.29	0.144

There were no significant main or interaction effects between the groups for order of teleconsultation presentation (telelink) or assessment (form) for age, years of education, time abstinent from drinking, the duration of drinking problems or the average daily intake of alcohol.

The distribution of categorical variables including sex, marital status, current employment status, and previous employment status between groups was analysed using Fisher's exact test. Due to the small number of subjects involved in each category, they were combined in order to form 2 comparison groups on 3 variables: marital status (single/separated v married/divorced/widowed), current

employment (paid employed/retired/unable to work v looking for work), and previous employment (Standard Occupation Classifications groups 1 to 5 v groups 6 to 9). The results are shown in table 6.

Table 6. Distribution of participants between the groups: categorical variables

	telelink P value	form P value
sex	0.678	0.678
marital status	0.704	0.704
current employment	1.000	1.000
previous employment	0.706	0.706

There were no significant differences between the groups for order of teleconsultation presentation or assessment used for sex, marital status, current and previous employment.

3.6 PERFORMANCE ON COGNITIVE ASSESSMENTS

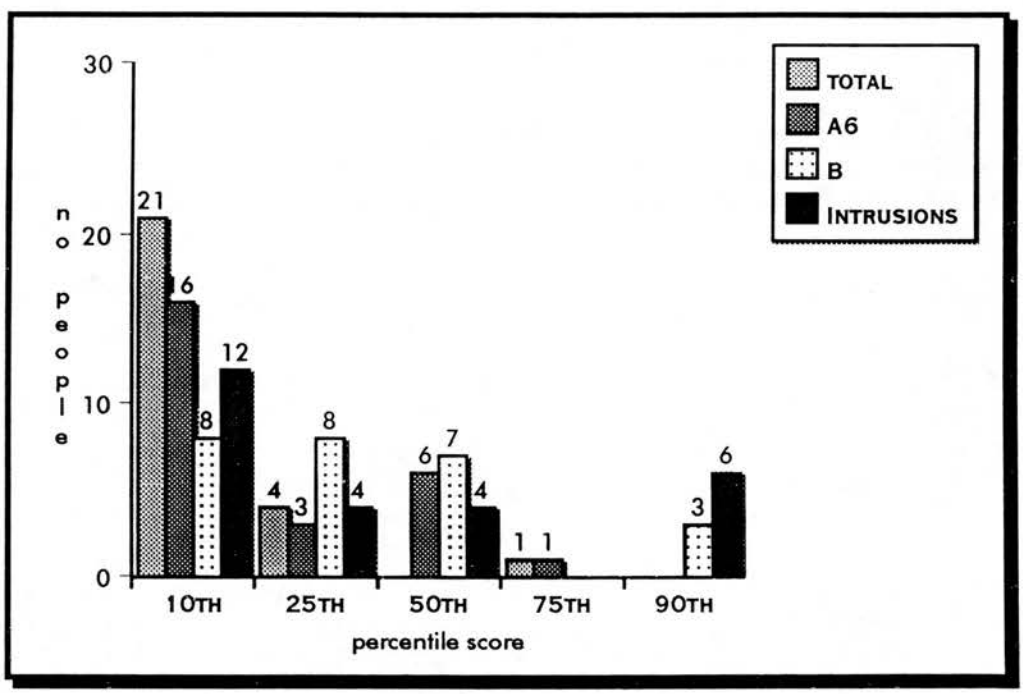
Individuals performance on cognitive assessments administered by the standardised procedure (i.e., face-to-face) indicated that participants current IQ ranged from 55 to 120 (mean 98.15, SD 12.35) as measured by the Quick Test. Premorbid IQ levels measured by the National Adult Reading Test (NART) ranged from 69-118 (mean 99.31, SD 13.12). The majority of individuals were within the average IQ range ie.90-109 on both premorbid (17) and current (20) IQ measures. There was no significant difference between individuals' current and premorbid IQ (mean -2.577, SD 12.29, t=1.069, p=0.295, 25 df, paired t-test). The 95% confidence interval of the difference between the means was -7.54 to 2.39.

Figures 4 to 7 show the results of participants assessments on the List Learning, Story Recall, Figure Recall and Information Processing tests. Each individual's score was compared with the relevant age related group norms according to which of the forms 1 or 2 the participant received in the face-to-face interview.

3.61 List Learning

Most individuals were impaired on the List Learning test, which is a measure of auditory verbal learning. When compared with age related norms the majority of individuals scored below the 10th percentile on total amount of words recalled in trials 1 - 5 , on recall after a distractor task (A6) and on intrusions. Scores were slightly higher for the amount of words recalled from the distractor list (B).

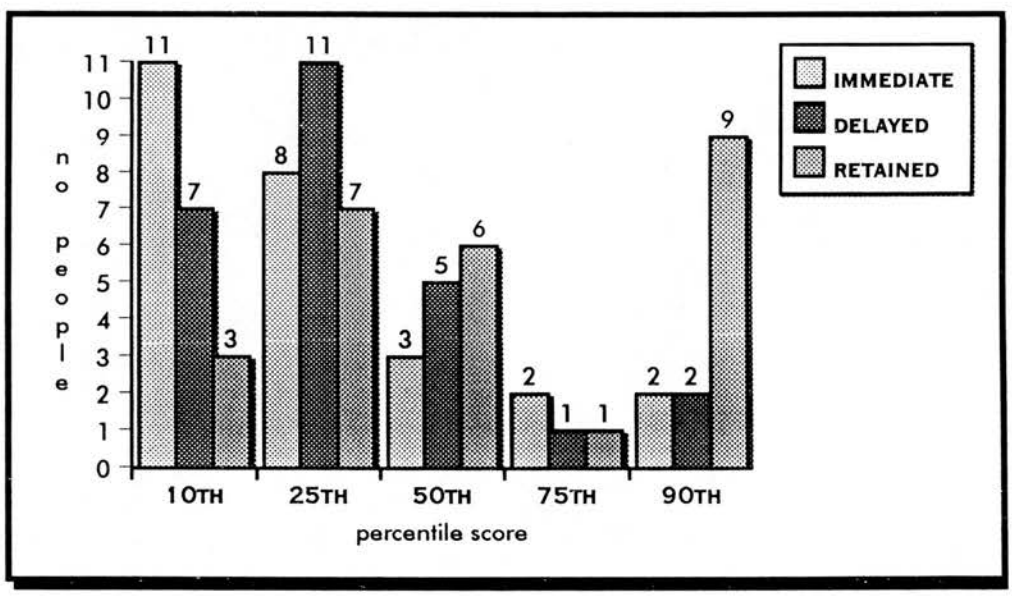
Figure 4. List Learning results



3.62 Story Recall

Most individuals were impaired on both immediate and delayed recall of a short verbal passage, scoring below the 50th percentile as compared with their own age-related norms. Coughlan & Hollows (1985) include age-related norms for the percentage of information retained between immediate and delayed recall on the Story and Figure Recall tests. A high percentage retained score does not necessarily indicate a good performance as a high percentage would be achieved by someone who recalled all items on both immediate and delayed recall but also by someone recalling only a few items on immediate and delayed recall.

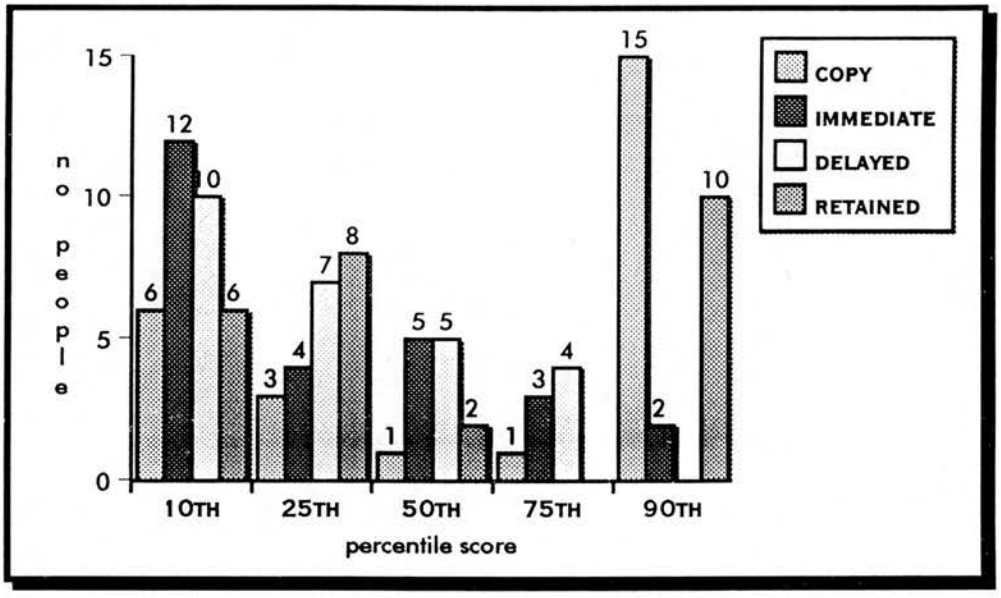
Figure 5. Story Recall results



3.63 Figure Recall

Most participants were able to copy the figure effectively, although most were impaired on both immediate and delayed recall. There was no clear pattern in participants' performance on the amount of information retained, with some retaining most of the information and others retaining very little.

Figure 6. Figure Recall results

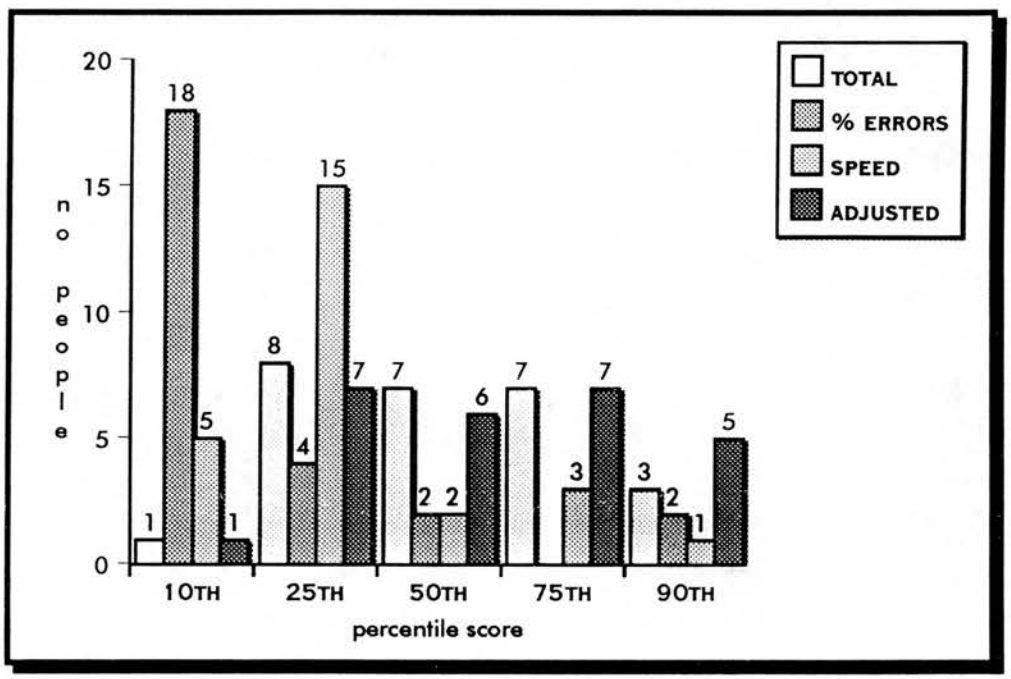


3.64 Information Processing A

The majority of participants scored higher on the Information Processing A task than on any of the memory tests, although a high percentage of errors was

recorded. Most participants were impaired on the speed test in comparison with their own age group. Overall, the total score and the adjusted score, which is based on total score and motor speed, showed a more even distribution amongst performance abilities.

Figure 7. Information Processing A results



3.7 TELECONSULTATION VERSUS FACE-TO-FACE

Overall, the average length of teleconsultation interviews (mean 40.7 minutes, SD 6.4) was significantly longer than face-to-face interviews (mean 33.0 minutes, SD 5.3) (t=7.78, P< 0.0001, 25 df, paired t-test). The 95% confidence interval of the difference between the means was 5.63 to 9.68.

Although individuals' performances on the Figure Recall, Story Recall retained and number of errors are expressed as percentages for purposes of comparison with age related norms (Coughlan & Hollows, 1985) raw scores were used for comparisons between face-to-face and teleconsultations as they gave an accurate measure of how well someone had performed on an assessment without being distorted by conversion to percentage scores as occurred with some measures, particularly Figure Recall.

3.71 Order of teleconsultation and assessment presentation

Order of teleconsultation presentation (ie. first or second) and order of assessment form presentation (ie. form 1 assessments first or second) were entered as factors into two-way analyses of variance calculations to investigate their effect on assessment performance. Statistically significant differences were found on three assessments at the $p<0.05$ level. To investigate the direction of the significant findings post-hoc t-tests were carried out. The available statistical packages were unable to conduct conventional post-hoc tests on two-way analysis of variance data. Although this could potentially increase the chance of a type I error by using an unadjusted significance level, it was considered acceptable practice in the circumstances given that the

significance of the results had already been established.

1. On teleconsultation assessment scores there was a significant main effect of order of interview presentation on the total amount of words recalled on the List Learning test (F=4.54, p=0.045, 1, 22 df). More words were recalled by those who received a teleconsultation first (mean 40.23, SD 6.23) than those who received a teleconsultation second (mean 35.46, SD 5.74) (t=2.03, p=0.0536, 24 df). The 95% confidence interval of the difference between the means was -9.62 to 0.08.

On teleconsultations there was a significant interaction effect of order of interview presentation and assessment form on the amount of words recalled after presentation of a distracter list (A6) (F=4.33, p=0.049, 1,22 df) on the List Learning test. There were also significant main effects of order of interview presentation (F=4.86, p=0.038, 1,22 df) and assessment form (F=7.62, p=0.011, 1,22 df). Post hoc t-tests showed that there was a trend for those who received a teleconsultation first (mean 8.15, SD 2.67) to score higher than those who received a teleconsultation second, although the results were not significant (mean 6.62, SD 1.94) (t=1.68, p=0.11, 21 df). The 95% confidence interval of the difference between the means was - 0.37 to 3.44. Participants who received form 1 (mean 8.38, SD 2.40) scored significantly higher than those who received form 2 (mean 6.38, SD 2.06) (t=2.28, p=0.032, 23 df). The 95% confidence interval of the difference between the means was 0.18 to 3.82. There were significant interaction effects between those who received form 1 and teleconsultation first (mean 10.17, SD 1.94) and those who received form 2 and teleconsultation first (mean 6.43, SD 1.90) (t=3.50, p=0.005, 11 df). The 95% confidence interval of the difference between the means was -6.09, -1.39. There was also a significant interaction effect between those who

received form 1 and teleconsultation first and those who received form 1 and teleconsultation second (mean 6.86, SD 1.57) (t=3.40, p=0.006, 11 df). The 95% confidence interval of the difference between the means was -5.45 to -1.17. These results are summarised in Table 7.

Table 7. Order of interview and form presentation on List Learning (A6).

		Form 1	Form 2
teleconsultation	1st	more words	less words
	2nd	less words	

2. On face-to-face assessment scores there was a significant main effect of order of interview presentation on the Information Processing A adjusted score (F=5.55, p=0.028, 1,22 df). Post hoc t-tests showed that those who received a face-to-face interview first (mean 63.6, SD 13.7) had a lower score than those who received a face-to-face interview second (mean 77.8, SD 15.4) (t=2.48, p=0.021, 23 df). The 95% confidence interval of the difference between the means is 2.3 to 26.0.

3. On face-to-face assessment scores there was a significant interaction effect of order of interview and assessment form on delayed Story Recall (F=6.43,p=0.019, 1,22 df). Post hoc t-tests showed that there was a significant difference between participants who received form 1 and a face-to-face interview first (mean 29.29, SD 6.42) compared with participants who received form 2 and a face-to-face interview first (mean 18.50, SD 10.48) (t=2.28, p=0.044, 11 df).

The 95% confidence interval of the difference between the means is -21.21 to -0.36.

There were no other statistically significant effects found for order of interview or assessment presentation on any of the other assessments. Using the Bonferroni adjusted significance levels of $p< 0.0125$ (List Learning), $p< 0.025$ (Story Recall) and $p<0.0125$ (Information Processing) to reduce the chance of a type I error would reduce the number of significant results. The only results that would remain significant are the recall of words after a distracter task on the List Learning test (A6) via the telelink: the main effect of order of form presentation and the interactions between those who received teleconsultations first and form 1 or 2 and those who received form 1 and teleconsultation first or second.

3.72 Comparison of assessment results via teleconsultation and face-to-face.

As the results showed that most assessment performances were not significantly affected by the order of interview or assessment presentation, all teleconsultation interviews were compared with all face-to-face interviews (n=26) using Pearson product-moment correlation coefficients. Significant correlations were found between teleconsultation and face-to-face interviews on the majority of assessments. Strong correlations were found for: the National Adult Reading Test (NART) (r=0.975), the Quick Test (r=0.855), Information Processing motor speed (r=0.827), total (r=0.782), adjusted score (r=0.749) and number of errors (r=0.722). Weaker, but still significant correlations were found for: List Learning total amount of words recalled (r=0.524), number of words recalled after a distracter list (A6) (r=0.509),

number of intrusions (r=0.491) and immediate Figure Recall (r=0.439). Correlations for all assessments are presented in Table 8. Significant correlations are presented in figures 11-20 in appendix 3.

Non-significant correlations were found on Story Recall for both immediate (r=0.284) and delayed (r=0.274) recall; on the amount of words recalled from the second (B) list (r=0.158) in the List Learning task and also on the copying (r=0.158) and immediate recall (r=0.300) from the Figure Recall test.

Table 8. Correlations of assessments via teleconsultation and face-to-face

	r	P value	95% CI
Nart errors	0.975*	<0.0001	0.94, 0.99
Nart IQ score	0.974*	<0.0001	0.94, 0.99
Quick test raw score	0.855*	<0.0001	0.70, 0.93
Quick test IQ score	0.802*	<0.0001	0.61, 0.91
Information Processing			
motor speed	0.827*	<0.0001	0.65, 0.92
total	0.782*	<0.0001	0.57, 0.90
adjusted score	0.749*	<0.0001	0.51, 0.88
no. of errors	0.722*	<0.0001	0.46, 0.87
List Learning			
total	0.524*	0.006	0.17, 0.76
A6	0.509*	0.008	0.15, 0.75
intrusions	0.491*	0.011	0.13, 0.74
B	0.049	0.813	-0.35, 0.43
Figure Recall			
copy	0.158	0.441	-0.24, 0.51
immediate recall	0.439*	0.025	0.06, 0.71
delayed recall	0.300	0.137	-0.10, 0.62
Story Recall			
immediate recall	0.284	0.160	-0.12, 0.60
delayed recall	0.274	0.176	-0.13, 0.60

*significant at $p<0.05$.

Within sample t-tests were used to analyse the mean differences between individuals performance on teleconsultation and face-to-face assessments.

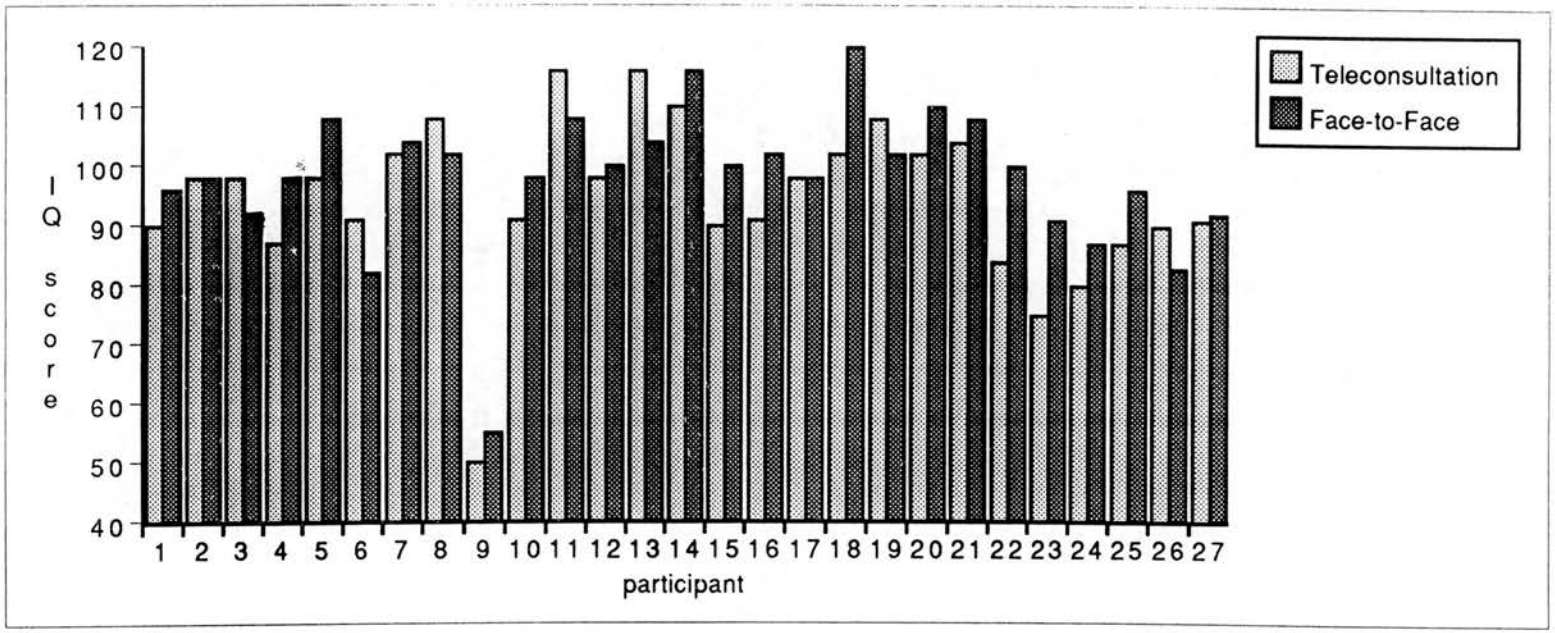
Statistically significant differences in individuals performances were found on two of the assessments: the Quick Test and the Information Processing A test. The Quick test raw score (t=2.76, p=0.011, 26 df) and converted Quick Test IQ score (t=2.23, p=0.035, 26 df) were higher on the face-to-face interviews. On the Information Processing A motor speed subtest individuals scored higher on the teleconsultation interview (t=2.45, p= 0.022, 25 df) and made less errors on the telelink presentation of the main Information Processing (t=2.29, p=0.031, 25 df). No other statistically significant differences were found in any of the other assessments (p<0.05). Using the Bonferonni test only the Quick Test raw score would remain significant (p<0.025). Results of comparisons between consultations and face-to-face interviews are presented in Table 9. Figures 8-10 illustrate the significant findings in relation to individual participant's performances.

Table 9. Paired t-test comparisons of assessments via video-link and face-to-face

	mean diff.	SD diff.	t	P value	df	95% CI
Quick Test						
raw Score	-1.59	3.00	2.76	0.011*	26	-2.78, -0.40
IQ score	-3.52	8.22	2.23	0.035*	26	-6.77, -0.27
Information Proc.						
motor Speed	1.80	3.76	2.45	0.022*	25	0.29, 3.33
errors	-0.96	2.14	2.29	0.031*	25	-1.83,-0.09
adjusted	-3.35	10.69	1.60	0.123	25	-7.66, 0.97
total	-1.77	8.05	1.12	0.273	25	-5.02, 1.48
Story Recall						
immediate	-0.81	11.03	0.37	0.712	25	-5.26, 3.65
delayed	-3.04	11.53	1.34	0.191	25	-7.69, 1.62
List Learning						
total	-1.46	6.48	1.15	0.261	25	-4.07, 1.15
A6	-0.35	2.70	0.65	0.519	25	-1.44, 0.74
B	-0.73	2.29	1.63	0.116	25	-1.66, 0.19
intrusions	-0.35	2.68	0.66	0.516	25	-1.43, 0.74
Figure Recall						
copy	-1.45	5.25	1.42	0.168	25	-3.58, 0.66
immediate	2.04	15.48	0.67	0.508	25	-4.22, 8.29
delayed	1.81	17.87	0.52	0.610	25	-5.41, 9.02
NART						
errors	0.15	2.36	0.33	0.74	25	-0.80, 1.11
IQ Score	0.00	2.97	0.00	1.00	25	-1.20, 1.20

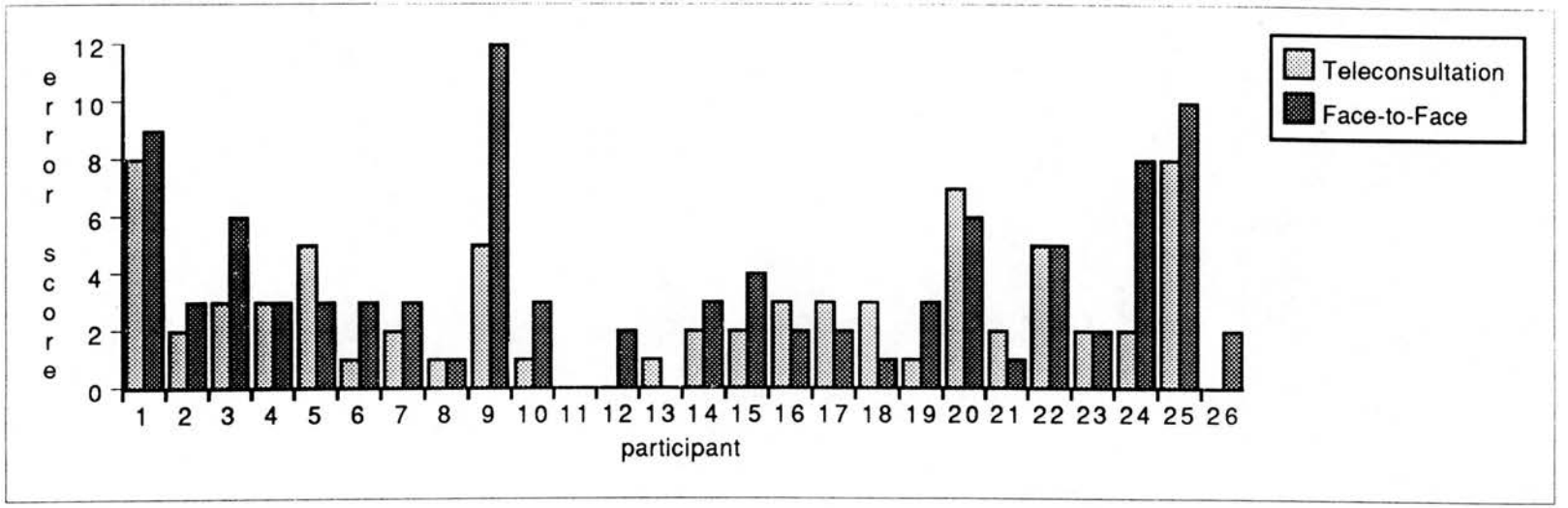
* indicates significance at p<0.05.

Figure 8. Quick Test IQ scores via teleconsultation and face-to-face



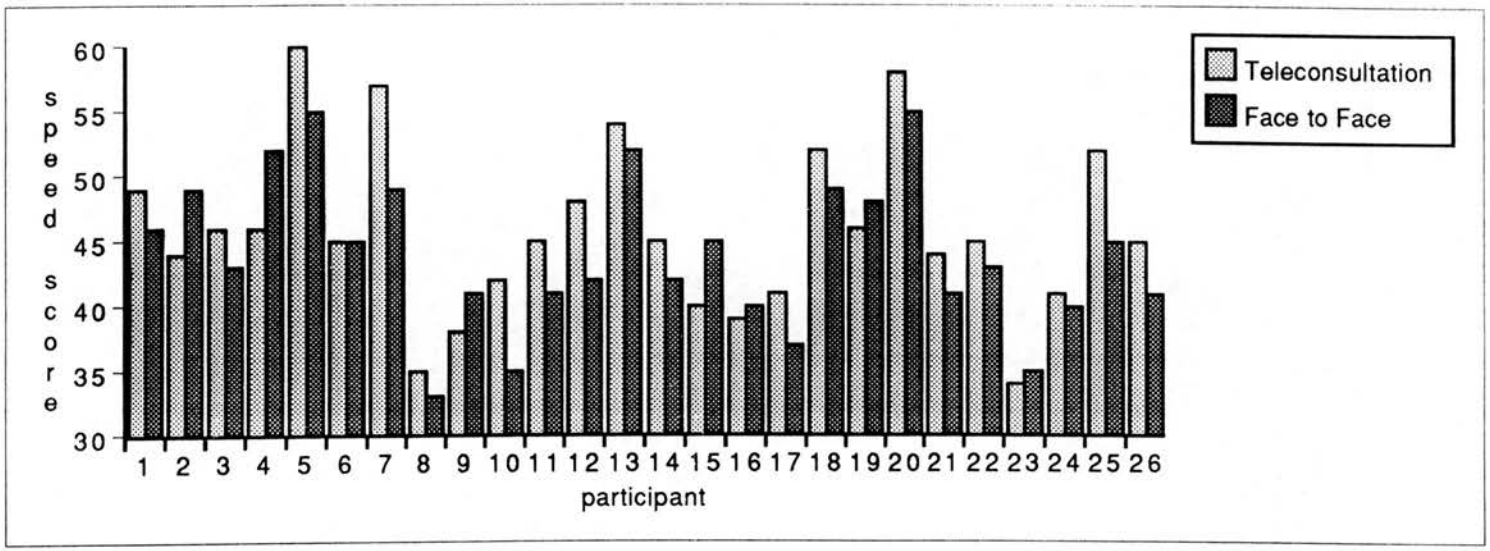
Eighteen participants were rated as having a higher IQ using the Quick Test in the face-to-face interview than via the television link. Seven had a higher IQ via the teleconsultation. This difference is significant at $p<0.05$ (binomial distribution). The 95% confidence interval of the difference is 0.544 to 0.896.

Figure 9. Information Processing A error scores via teleconsultation and face-to-face



Fourteen participants made more errors on the Information Processing A task when presented face-to-face than they did via teleconsultation. Seven participants made more errors on this task when presented via the television link. This difference is not significant at the $p<0.05$ level (binomial distribution). The 95% confidence interval of the difference is 0.445 to 0.895.

Figure 10. Motor Speed score via teleconsultation and face-to-face



Eighteen participants scored out more items on the motor speed test when presented via television link than they did in the face to face interview. Seven participants scored out more items on the face-to-face interview. This difference is significant at $p<0.05$ (binomial distribution).

3.8 SATISFACTION QUESTIONNAIRE

The 27 participants were given the satisfaction questionnaire. Respondents had to rate their satisfaction with four aspects of the teleconsultation on a ten point scale and answer three questions. Twenty six people completed the full questionnaire and one person did not complete the visual analogue scales. A summary of the responses to the visual analogue scales is given in Table 10 (low scores indicate low levels of satisfaction).

Table 10. Satisfaction Questionnaire visual analogue scales

	mean	SD	range	median
sound quality	7.58	2.14	2-10	8
picture quality	7.92	1.98	4-10	8
ability to communicate	8.15	1.97	4-10	9
overall satisfaction	8.88	1.63	5-10	10

Overall, the majority of participants were satisfied with the teleconsultation and felt that it was easy to communicate with the investigator (mean 8.15, SD 1.97). The average ratings for the sound and visual quality of the equipment were also high. The majority of people said that they would use the video-link again (22), three were unsure and one person said that they would not like to use it again. There were no significant differences on any of the visual analogue ratings between those participants who received a teleconsultation first and those who received a face-to-face interview first (two-sample t-test).

Although the average ratings for sound and picture quality were fairly high, more difficulties with these aspects of the equipment were recorded in the open questions than for any other aspect of the teleconsultation interview. Twenty two people responded to the open questions at the end of the questionnaire which asked participants for general comments and what they felt had been the best and worst things about the teleconsultation assessment.

Some typical comments from participants about the teleconsultation assessment include:

> *"It felt as comfortable as the face-to-face consultation."*
> *"Blushing is not seen over the television link!"*
> *"The sound was not too good."*
> *"It was weird.""*
> *"I thought that it was a lot different from the face-to-face interview....it was much better when seeing someone for the first time as it helped me to relax before I actually met ....(the interviewer) in person."*

Among the things that people reported they liked best were: everything (including generally finding the experience interesting or unusual) (5), feeling relaxed and at ease (8), no effort needed in using the equipment (3) and having access to a health professional (3). Other things that people liked about the teleconsultation were not having to travel and being able to communicate from a different location (1), finding it easier to concentrate on the assessments than in a face-to-face situation,(1) and the assessments themselves (1).

When asked what participants felt was the worst thing about the teleconsultation assessment, six people reported that it was difficult to pick up

words that the investigator was saying or that there were general problems with the sound. Three found the delay in communication a problem. Other problems reported were: the picture breaking up (1), having to remember things during the assessments (1), outside noise (1), no personal presence (1), when the investigator is not seen on the screen (ie. when things are shown on the video-imager) (1), feeling nervous (2) and finding the experience unusual (1). Five people reported that there was no worst thing about the teleconsultation assessment.

CHAPTER 4 DISCUSSION

There were no significant differences in the majority of cognitive assessment outcome measures presented via telecommunication links and those presented face-to-face, which supports the hypothesis that conducting cognitive performance assessments via telecommunication links is reliable.

This discussion will focus on: reporting the cognitive functioning deficits of participants; the implications of the equivocal assessment results via teleconsultation; and the effects of the assessments, study design and teleconsultation equipment on the outcome. Participants views on the teleconsultation were generally positive, although many reported problems with sound quality which could interfere with the effectiveness of communication via telelink.

4.1 COGNITIVE DEFICITS IN INDIVIDUALS WITH A HISTORY OF ALCOHOL ABUSE

Standard assessment presentation i.e. face-to-face, showed that most individuals were impaired on the verbal and visual memory tests but were performing better on tests of attention and concentration (i.e. scoring above the 50th percentile, apart from the motor speed and number of errors scored which were generally below the 50th percentile) and were within the average range for the general population on intellectual assessment. This reflects the outcome of previous

studies with individuals who have alcohol induced cognitive deficits (eg. Spreen & Strauss, 1998; Glenn & Parsons, 1990; Mearns & Lees-Haley, 1993) and shows that the participants in this study were a representative sample from this particular client group. Recruitment criteria did not exclude anyone with a head injury or other disability or illness. Although this would have implications for interpretation of the results in a clinical setting there were insufficient numbers of participants to look at sub-groups of clients separately. The primary aim of the project was to investigate the assessment medium and therefore by including all participants, regardless of other disabilities, meant that the clinical sample was typical of clients who would normally be referred to Clinical Psychology for assessment.

4.2 TELECONSULTATION VERSUS FACE-TO-FACE

4.21 Order of teleconsultation and assessment procedure

All participants received interviews via both mediums and completed both forms 1 and 2. The results of three of the assessments; Story Recall, Information Processing and List Learning were affected by the order of interview and/or assessment form presentation. For individuals who received a face-to-face interview first their delayed recall scores on the Story Recall were higher on form 1 than on form 2. This difference occurred despite the total maximum score possible for form 2 being higher than for form 1 (60 compared with 56 for Form 1). The story in form 2 is longer than the story in form 1 and informal analysis suggests that it is more complex, and contains material that is less familiar to

individuals than the story in form 1. Although not statistically significant for teleconsultations, participants who were given form 2 had poorer recall in comparison to form 1. Coughlan & Hollows (1985) report a test-retest correlation of 0.47 for delayed recall, which although statistically significant, does not indicate a strong relationship and is lower than correlations for other AMIPB tests. This would suggest that form 1 and form 2 of the Story Recall are not of comparable difficulty.

Adjusted scores on the face-to-face Information Processing test were higher for those who received a face-to-face interview second than those who received a face-to-face interview first. Participants who completed the test in the second interview face-to-face were already familiar with the test having done the assessment and met the investigator over the telelink. Both of these factors may have helped the participant to feel more confident and relaxed, leading to a better performance under face-to-face test conditions. Tests which incorporate a speed component are susceptible to practice effects (Bornstein, Baker & Douglass, 1987) and the adjusted Information Processing score is calculated from total and speed scores. Although the results were not significant, the fact that some participants who completed the test via telelink after having done the task face-to-face, also had better overall performances, adds support to this explanation.

On the teleconsultations there was a significant main effect of order of interview presentation on the total amount of words recalled on the List Learning test. More words were recalled by participants who received a teleconsultaion first than those who received a teleconsultation second. Significant interaction effects were found for form and interview presentation on the List Learning task for recall of list A after a distracter list (B). More words were recalled by participants who received teleconsultations first and also by those who received form 1

assessments first. The results suggest that after completing the test in the face-to-face interview, participants were beginning to tire and so did not perform as well on the second presentation of the test via telelink. Performance may be more affected on the second teleconsultations than the second face-to-face interviews due to the added concentration needed to deal with the sound difficulties of the telelink. It is more difficult to explain the difference in words recalled for forms 1 and 2. One explanation is that the distracter list on form 2 had a significantly greater effect on the recall of the original list than the distracter list on form 1, although this would seem unlikely.

Overall, the effects of form and interview presentation can be mostly explained by differences in test difficulty for the Story Recall test, practice effects on the Information Processing test, and test fatigue compounded by sound difficulties on the List Learning test. Apart from the poor sound quality, these factors would affect test-retest results on any assessment presentation and are not unique to teleconsultations. The results for the different forms of the List Learning test are more difficult to explain. It is possible that this is a chance significant result due to the number of analyses carried out. Repetition of the study with a greater number of participants is needed to confirm the results.

4.22 Comparison of assessment results via teleconsultation and face-to-face

The results showed that participants performance on the majority of cognitive tests were consistent with standard face-to-face presentation when given via telecommunication links. Two tests showed inconsistencies between the two medium; current IQ scores as measured by the Quick Test were consistently

higher on face-to-face presentation, and on the Information Processing test total scores were higher and less errors were made on the teleconsultation.

Other studies have found no significant differences between IQ measures on automated and standard presentation of the Quick Test. Price, Herbert, Walsh & Law (1990) studied the efficacy of the Quick Test and the Peabody Picture Vocabulary Test (PPVT) in predicting WAIS-R IQs in a sample of neuropsychiatric patients. Using standard and automated versions of the Quick Test, they found that it overestimated all three WAIS-R IQs, as did the PPVT. The main difference to the Price *et al.* (1990) study was that in the 'automated' version of the Quick Test in this project, participants were shown the test material from a distant location and had to respond verbally to the test words which were also given verbally. Two possible factors which could have resulted in the consistently poorer performance via teleconsultation are; the adequacy with which participants correctly heard the test words, and how clearly they could see the pictures over the television link. From the pilot study versions one and three of the test were chosen as they could be seen most clearly over the telelink, however the drawings are not of particularly high quality. Voice transfer is another possible explanation; for example, the investigator found that words from the List Learning test were often recalled wrongly over the telelink, i.e. participants often said 'mouth' when they had been given the word 'mouse'. It is possible that the participant misheard some of the words from the Quick Test. Getting clients to consistently repeat the word after each presentation to ensure that they had correctly heard the word; improving the quality of the drawings or using an alternative measure of current intellectual functioning which does not rely on pictures; in addition to using more sophisticated videoconferencing equipment, are possible solutions to this difficulty. Many studies have used an assistant at the remote site who sits beside the client and shows them the relevant assessment material on direction from the clinician at the other site (eg. Ball & Puffett, 1997).

Using this method in the present study would have had the advantage that the assessments were not affected by the transmission method, but would have created the need for additional manpower. Having another person present during the assessment may also have a detrimental effect on performance as is suggested by the results from the Information Processing A test which are discussed next.

Fewer errors were made by the majority of individuals when given the Information Processing A test via telecommunication links than they did when the investigator was sitting in the same room as them. This assessment involves performing a fairly simple task under pressure. Previous studies have suggested that telemedicine is less intimidating for individuals than face-to-face settings (Bloom, 1996). The more relaxed environment created by the teleconsultation in addition to the fact that their responses were not being directly observed could account for this improved performance. Although participants were aware of being observed generally, in many cases during the teleconsultation it became evident to the participant that the investigator could not see everything that they may be doing. One example of this was when the investigator had to ask the participant whether they were writing anything during the Story Recall test. The investigator could see that they were holding a pencil but not whether they were taking notes. Being aware that not all their actions could be observed via the telelink may have helped participants relax. Using split-screen technology which would allow the assessment form to be viewed at the same time as the client was performing the test would help clarify which of these factors i.e. personal presence and/or being observed, had the greater influence on performance.

There was a significant difference on the motor speed test from the Information Processing A test via telelink. On this test participants are given a time limit of four minutes to complete the main number cancellation task and 20 seconds in which to complete the motor speed test. No differences were found on the main

task but participants were able to complete more items on the speed task in the teleconsultation. The teleconsultation has a delay of one to two seconds which may be sufficient to make a difference between the time the investigator asks the participant to stop doing the task and the time that they receive the command. As the investigator cannot see the assessment form and observe exactly when the participant starts the task it is possible that they may also begin the test before the investigator tells them to begin and starts timing. The increased time limit of the main task appears to eliminate these timing effects.

Increasing the bandwidth of the system would improve accuracy by reducing the time delay. Previous studies with computerised tests have been used to measure cognitive deficits in individuals with a history of alcohol abuse and have enabled greater control over testing conditions, including timed performances. For example, MacDonell, Skinner & Glen (1987) used two computerised neuropsychological tests; Cogfun II and the Perceptual Maze Test, to measure conceptual and problem solving ability in 48 detoxified alcoholics. Combining neuropsychological testing procedures with two-way audiovisual connections using computer software would allow for greater accuracy in timed tests but still maintain the clinical advantage of being able to visually observe and talk to the client. To the author's knowledge no systems incorporating these features have yet been developed.

4.3 COGNITIVE ASSESSMENTS

Apart from the NART, parallel versions of the other tests were used. The NART was repeated in its complete form as no parallel version was available, practice

effects are small and it has been shown to have good test-retest reliability (0.98) (Crawford *et al.* 1989). In retrospect, presenting half the test in each medium may have been more efficient as the NART has good split-half reliability (0.90) (Crawford, Stewart, Garthwaite, Parker & Besson, 1988) and this would have had the advantage of making the assessment procedure shorter.

This is the first known study which has used parallel versions of test material. Other studies have retested patients on separate occasions using the same assessments when comparing teleconsultations with face-to-face interviews or have tested different individuals under each condition (eg. Ball *et al.* 1993; Zarate *et al.* 1997). Caution must therefore be used in interpreting correlations of studies which use the same test via face-to-face and telelink, as practice effects are likely to inflate the results. Testing separate groups of individuals under each condition introduces the effect of individual differences which affects the generalisability of results.

The majority of correlations between assessment measures on face-to-face and teleconsultations in this study were significant but of varying strengths. For assessments via telelink to be incorporated into clinical practice they would need to be sufficiently reliable for clinicians to feel confident in using them. To be able to say exactly how reliable an assessment would need to be is difficult, but one possible guideline would be comparing reliability of teleconsultation and face-to-face performance with the reliability of normal test-retest performance. For example, reliability of the MMSE via telecommunication links has been consistently shown ranging from 0.89 (Ball *et al.* 1993) to 0.95 (Montani, Billaud, Tyrrell, Fluchaire, Malterre, Lauvernay, Couturier & Franco, 1997). This compares favourably with normal test-retest correlations of 0.80 to 0.95 (Tombaugh & McIntyre, 1992). Obviously there are many other factors which relate to the validity of a test such as internal consistency and interrater reliability,

but if correlations between mediums are the same or higher than test-retest then this would be an indicator of the validity of conducting the test via telelink in the knowledge that it was *as* reliable via telelink as it would be normally. Parallel forms are useful in this case as they reduce the risk of practice effects as mentioned previously.

In this study correlations between the teleconsultation and face-to-face interviews were similar to inter-test correlations for the Quick Test (0.79) (Price *et al.* 1990) and to test-retest correlations for the NART (0.98) (Crawford *et al.* 1989), and Information Processing A (0.79 to 0.83) (Coughlan & Hollows, 1985). Performances on these tests were less affected in individuals with alcohol related impairment and so correlations would be expected to be similar to normal population data. Unfortunately no data was available on the performance of individuals with alcohol related impairment on the AMIPB and so it is not possible to say whether the lower correlations between mediums (than was reported in Coughlan & Hollows (1985) test-retest data) which were found for the Story Recall, Figure Recall and List Learning tests is to be expected in this clinical sample or whether it suggests that these tests are less reliable via telelink due to the greater variation in performance. If assessments are not consistent on repeat testing under normal circumstances it would be difficult to say whether differences on assessment via telelink were due to test unreliability, the interview medium, or individual's cognitive deficits.

4.31 Adaptations to standard assessment procedure

Several adjustments were made to the assessment procedure in order that they were possible over telecommunication links. For the Figure Recall test participants were requested to place their completed diagrams back in the

envelope after the copy, immediate and delayed recall. As in the Ball *et al.*(1993) study minor adjustments to the standard assessment procedure did not affect the outcome on test scores. Although no significant differences were found in outcome measures from using this method of presentation and the standard procedure, these alterations have implications for clinical practice. It was not possible to directly view how clients were recalling the figure, for example, whether they started with the main outlines or the smaller features, or as happened in one occasion in this study, the participant used another pencil as a ruler when copying the diagram to ensure straight lines. It was also not possible to score the test or to give immediate feedback on participant's performance. This would interfere with the flexibility needed in neuropsychological testing, for example, if clients were having severe difficulty with the visual memory recall task the psychologist may want to change to a recognition task or move on to another simpler test. If the procedure used in this study was to be used in clinical practice it would require efficient preconsultation and planning in order to send the tests and get them returned, or the use of additional technology such as fax or screening facilities to send the forms directly to the patient. A second video-imager at the patients' site would allow the clinician to observe the client completing the form, however this would have its own limitations in that the clinician would be unable to see the client at the same time without a split screen facility. It would also involve more input from the client in adjusting the equipment. These factors make it unlikely that this would be practical in a clinical setting and research is needed to find alternative methods of assessing visual memory which deal with these problems.

At present, the use of cognitive tests is constrained by what the telecommunication equipment will allow the psychologist to do. Manufacturers have been criticised for not involving users in the development process (Fussell & Benimoff, 1995) and psychologists and developers need to collaborate on

equipment designs that will maximise the clinical reliability and validity of cognitive assessment at a distance.

4.4 STUDY DESIGN

An equal number of participants received teleconsultations and face-to-face interviews first. Recruitment procedures meant that some of those who received a teleconsultation first had met the interviewer in person and some had had telephone contact with her prior to the interview. This was not formally recorded and the effect this may have had on the outcome is unknown. Individual comments from participants reveal a range of preferences regardless of previous contact, for example one participant who had been contacted on the telephone preferred meeting via the telelink first of all as it reduced her anxiety about meeting the interviewer in person. There did not appear to be any pattern to whether people kept their appointment or how they reacted to the teleconsultation dependent on the method by which they had been recruited. The interviewer felt that prior contact with participants may have helped build rapport at the beginning of the teleconsultation, but that individual characteristics of the participant were more relevant. Frequency and type of contact with participants before a teleconsultation was not controlled for in this study. Previous studies have recognised the potential effect of carrying out teleconsultation research with clients already known to the interviewers. Ball, McLaren, Summerfield, Lipsedge & Watson (1995) suggest that study outcomes may be positively biased because those who volunteer to take part in projects are more compliant

and eager to please their doctors. Future research needs to consider the effect of prior contact with clients on assessment outcome.

Previous studies which have used individuals as their own controls have normally had a gap of several days between testing. This study differs from previous studies as the majority of participants were non-hospitalised volunteers. Several participants requested feedback on their assessment results but the majority took part out of their own good will. The study was designed so that individuals would only need to attend the hospital on one occasion which meant that each participant was completing two periods of approximately half hour assessment within two hours. It might be expected that people would be tiring towards the end of the second interview, however, this did not appear to affect the results significantly. One noticeable effect of completing the two sets of assessments within a short time span was that word intrusions on the List Learning test on the second interview often came from the word lists used in the first interview.

Testing the same participants and on the same day, made parallel forms of assessments necessary and ensured that demographic variables and individual factors such as mood, behaviour and cognitive ability remained constant for both comparison interviews. The use of parallel assessment forms creates an additional variable of assessment difficulty into the study, however, there was a limit to the assessments that could be carried out via telelink and the tests that were used were considered to be sufficiently reliable to assess a range of cognitive functions. There may be tests that provide better measures of abilities but which are not easily conducted via telelink, for example, the Corsi Block test of visual memory. Unfortunately all these situations i.e. using different people but the same assessments, a longer intervening time between assessments or the use of parallel forms involve a degree of compromise.

The study did not include either a separate non-clinical control group or sample with a different clinical problem. The generalisability of these results to other client populations is therefore limited without further research. The main focus of this study was to investigate the differences in performances on cognitive assessments via telecommunication links as compared to face-to-face in a clinical sample. Using each individual as their own control had the advantage of allowing direct comparisons between performances via the two mediums. Participant characteristics were identical in both situations and any differences in performances could then be attributed to the method of assessment presentation. A separate control group tested under both conditions may have been useful to assess how a non-clinical group would react to the teleconsultation, but was not included due to the difficulty in achieving an adequately matched non-clinical group, and because it was not clear what advantage it would provide to clinical practice to report the assessment outcomes from a group of non-impaired adults under both conditions.

4.5 LIMITATIONS OF TELECONSULTATION

Poor system management was one of the major reasons why previous systems failed to develop (Preston, 1992). From this study, it was evident that practical issues which are taken for granted in normal circumstances need to be carefully planned when organising teleconsultations for it to be efficient and acceptable to both clients and professionals. For example, it is important to make sure that there is someone at the remote site who is available for welcoming and being responsible for the care of the patient during the consultation. This point was highlighted during the current project when the fire alarm went off at the

participant's hospital site and the investigator had to telephone administration staff at the site to ensure there was no immediate danger to the client. The need for on-site staff and an additional communication mode was also emphasised on another occasion when machine faults caused by bad weather, led to the picture 'freezing'. To resolve the problem the investigator had to telephone administration staff who were then able to restart the videoconferencing equipment. These issues have the potential for creating panic and uncertainty in clients if they are not adequately addressed beforehand. There has to be clear lines of responsibility at the telemedicine site and clients need to know who to approach for help should difficulties occur.

4.6 EFFECTIVE COMMUNICATION

Effective communication requires several factors (Infante *et al*. 1997). The main aspect of communication which was particularly affected by the teleconsultation in this study was the quality of the voice transmission.

Many people reported difficulties with the sound quality of the telelink, particularly those who had some hearing difficulty. Although using the handset (similar to a telephone handset) reduced the delay, it was not possible to use this when carrying out assessments and also when the handset was replaced, the call was disconnected which limited the possibility of using the handset for some of the tests. The teleconsultation equipment used in this project only showed the participant from the chest upwards. Fussell & Benimoff (1997) who advocate the use of a larger visual field are critical of the use of handsets because they restrict the amount of gestures possible and interfere with the natural communication

process. Noise from outside the teleconsultation room also caused interference for some participants and so it is important to position the telemedicine equipment in a room where noise levels are low and confidentiality can be ensured, for example by not positioning it in a room directly off a waiting area where other patients sitting outside are able to hear and where outside noise could interfere with the consultation.

Although not formally assessed, the investigator was aware that there was less verbal interaction between participant and investigator in the teleconsultation assessment than in the face-to-face interview. This was particularly evident in the List Learning test where, due to the time delay, an instruction given by the investigator to begin would often overlap with the participant starting to recall words. Cukor & Baer (1994) have made several suggestions to maintain effective turn-taking in conversation: waiting to ensure that the other person has finished before beginning; by not relying on lip movements to signify the end of a conversation, as these are often not synchronized with the sounds; and having pre-arranged 'rules of conversation'. The investigator in this study found that, for the List Learning test in particular, it was useful to rely more on visual cues to signal the end of a conversation by looking up at the participant when she had finished reading the word list, then waiting for the participant to begin recall without giving a verbal instruction after each trial.

A major drawback of the teleconsultation for the investigator was the inability to see individuals' facial expressions clearly. On one occasion during the assessment a participant looked upset but it was not possible to see if they were crying. It was necessary for the investigator to ask the participant several times if they wished to continue as they were unable to perceive subtle cues that would have been picked up in a face-to-face interview. They were also unable to offer comfort as would have been done in a face-to-face interview for example, by the

simple gesture of handing the person a tissue. This lack of visual clarity and inability to pick up subtle gestures has implications for the use of telemedicine for clinical purposes where a substantial amount of the nonverbal communication which can contribute significantly to the quality of the consultation depends on these factors. Other studies have reported similar difficulties with the inadequacy of the television link in assessing a person's self neglect (Salzman *et al.* 1996).

4.7 SATISFACTION WITH TELECONSULTATION

The majority of people rated the teleconsultation as satisfactory which reflects the results of previous studies which have used questionnaires to assess client satisfaction with telemedicine (eg. Dongier *et al.* 1986). Questionnaires were also used in this study and participants complained mainly of poor sound quality, although this was not evident from the results of the visual analogue scales. This suggests that the use of open questions and interviewing techniques in the assessment of participant satisfaction would provide more accurate results than rating scales alone.

The majority of sound problems can be technically overcome by increasing the bandwidth and eliminating the time delay. Poor sound quality is more easily defined than the ambiguous effects of distance. Further research would be needed to assess whether improving sound quality increased individuals satisfaction with telemedicine, or if there was still a residual dissatisfaction with the lack of personal presence.

Previous studies have been criticised for not involving patients in the planning stage of telemedicine projects and only asking for their views after the event. Gott

(1995) complains that the main benefactors of current systems are the manufacturers who sell more equipment and the service providers who can say that a service is being provided to clients. Involving clients in telemedicine planning is difficult as many may not be aware of the available technology or its limitations. As was the case with this study, often projects are limited to using the available telemedicine systems and do not have additional funding for more sophisticated equipment when the current equipment is seen as inadequate. Evaluation is greatly lacking and planning managers need evidence of the efficacy of systems before being willing to fund additional projects.

4.8 SUMMARY

For the majority of outcome measures, cognitive assessment via teleconsultation was as reliable as assessment via face-to-face. Technical limitations of the equipment and differences in parallel forms of assessments can provide explanations for the few differences that were found. Teleconsultation may have advantages for cognitive assessment over face-to-face assessment by reducing performance anxiety in participants created by the personal presence of the interviewer.

The main aspects of cognitive assessment affected by video-link transmission were the inability to directly view responses and be flexible in the presentation of assessment procedures. In clinical practice this would require good organisation and planning prior to appointments by sending the appropriate material to the remote site. Immediate feedback and evaluation of assessment results were not possible. The telecommunications equipment limited the range of assessments which could be used which has implications for the variety of cognitive functions which can be assessed via teleconsultation in clinical practice.

Participants were generally satisfied with the teleconsultation and the majority would be happy to use it again in the future. Problems with the sound quality were apparent, and for the investigator the lack of picture clarity caused problems in identifying facial expressions. Sound and picture quality could be improved by increasing the bandwidth of the equipment.

4.9 CONCLUSIONS

Providing adequate Clinical Psychology services to individuals in remote areas is difficult. This study looked at the use of telecommunication links for cognitive assessment, with the aim of being able to expand the range of psychological services available to rural areas. The results showed that with a limited range of assessments, in individuals with a history of alcohol abuse, it would be feasible to provide a cognitive assessment screening service for this client group at a distance.

Qualitative aspects of normal consultations which have clinical importance were compromised by the existing videoconferencing equipment. This would suggest that at present teleconsultations should not be used as the sole method of assessment for individuals, and, that they should be incorporated into a package of care which includes face-to-face contact.

Professionals need to be confident in their judgments about clients' abilities based on the teleconsultation and this will be affected by how valid and reliable they view telemedicine. The future development of telecommunications in Clinical Psychology depends on the collaboration of psychologists and developers to design systems which are efficient and allow flexibility. The clinical validity of telecommunication links for cognitive assessment needs further evaluation in controlled trials, with a wider range of assessments and client groups.

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APPENDIX 1

Information sheet

INFORMATION SHEET
TELECONSULTATION PROJECT

The aim of the project is to test the reliability of carrying out psychological assessments using interactive TV (teleconsultation). It is hoped that using teleconsultation for this purpose will improve the service that can be provided to people in remote areas.

Taking part in the study will involve answering some questions and completing some memory tasks. This will take place at Craig Phadrig Hospital, Inverness. Half of the assessments will be carried out using the teleconsultation equipment, the other half will be carried out face-to-face with the investigator. There will be a short break (30 minutes approx.) between the two sessions which should take altogether about two hours. Both sessions will take place at Craig Phadrig Hospital.

A member of staff will be on hand at all times when using the teleconsultation equipment and all responses you give will be confidential.

If you do not want to get involved or if you decide to withdraw from the project at any stage your treatment and support will not be affected.

APPENDIX 2

Satisfaction Questionnaire

NAME:..... DATE:.....

FOR QUESTIONS 1-4 PLEASE CIRCLE THE APPROPRIATE NUMBER

1. How would you rate the sound quality of the teleconsultation equipment?

poor 1___2___3___4___5___6___7___8___9___10 good

2. How would you rate the picture quality of the teleconsultation equipment?

good 10___9___8___7___6___5___4___3___2___1 poor

3. How easy was it to communicate with the investigator using the teleconsultation equipment ?

easy to communicate 10___9___8___7___6___5___4___3___2___1 difficult to communicate

4. Overall, how comfortable were you using the teleconsultation equipment ?

comfortable 1___2___3___4___5___6___7___8___9___10 not at all comfortable

FOR QUESTION 5 PLEASE CIRCLE THE APPROPRIATE ANSWER

5. Would you use teleconsultation again? yes / not sure / no

PLEASE COMPLETE THE FOLLOWING SENTENCES

6. The **best** thing about the teleconsultation assessment was

_____

7. The **worst** thing about the teleconsultation assessment was

_____

8. Any other comments (please use reverse side of page if necessary):

THANK YOU FOR YOUR CO-OPERATION

APPENDIX 3

Correlations between teleconsultation and face-to-face assessment results

CORRELATIONS BETWEEN TELECONSULTATION AND FACE-TO-FACE ASSESSMENT RESULTS

Figure 11. NART errors

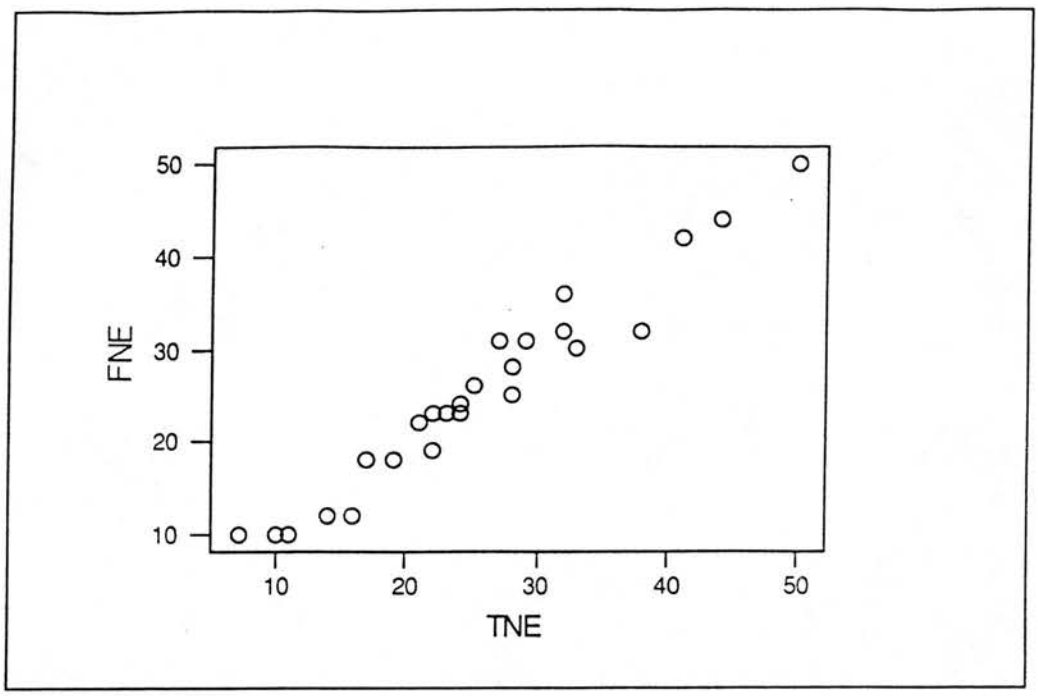

Figure 12. Quick Test raw score

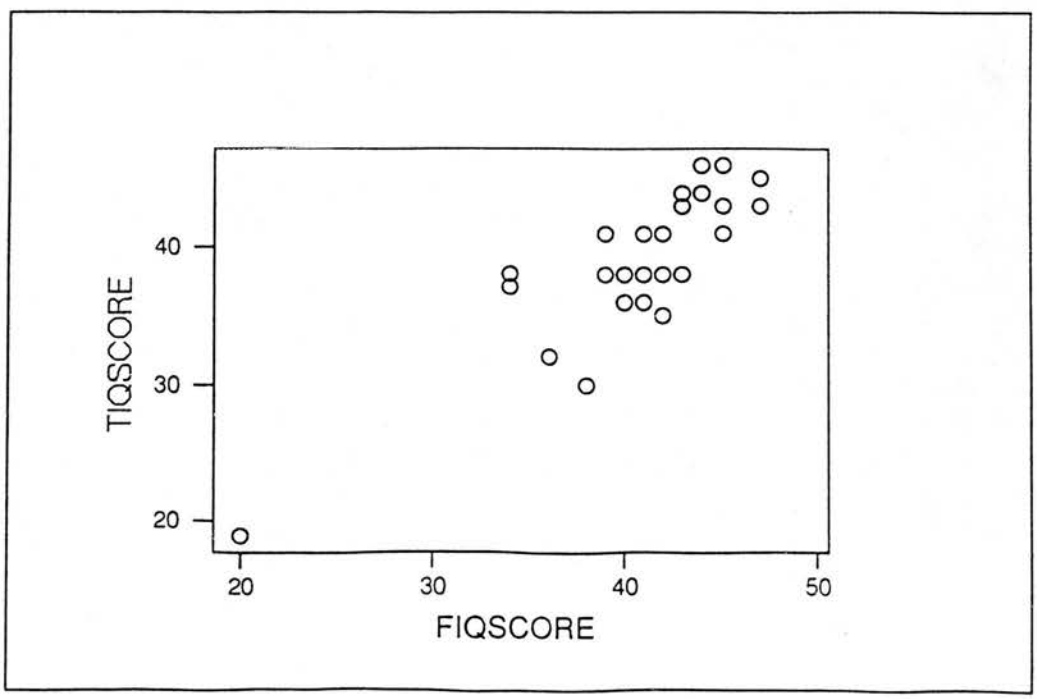

Figure 13. Information Processing A total score

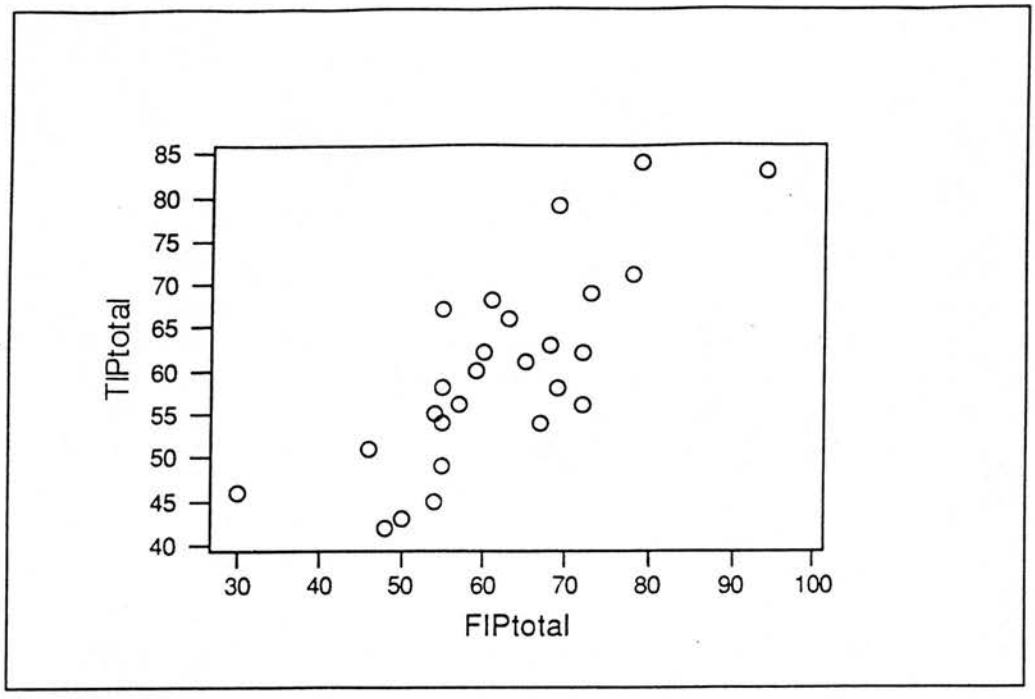

Figure 14. Information Processing A adjusted score

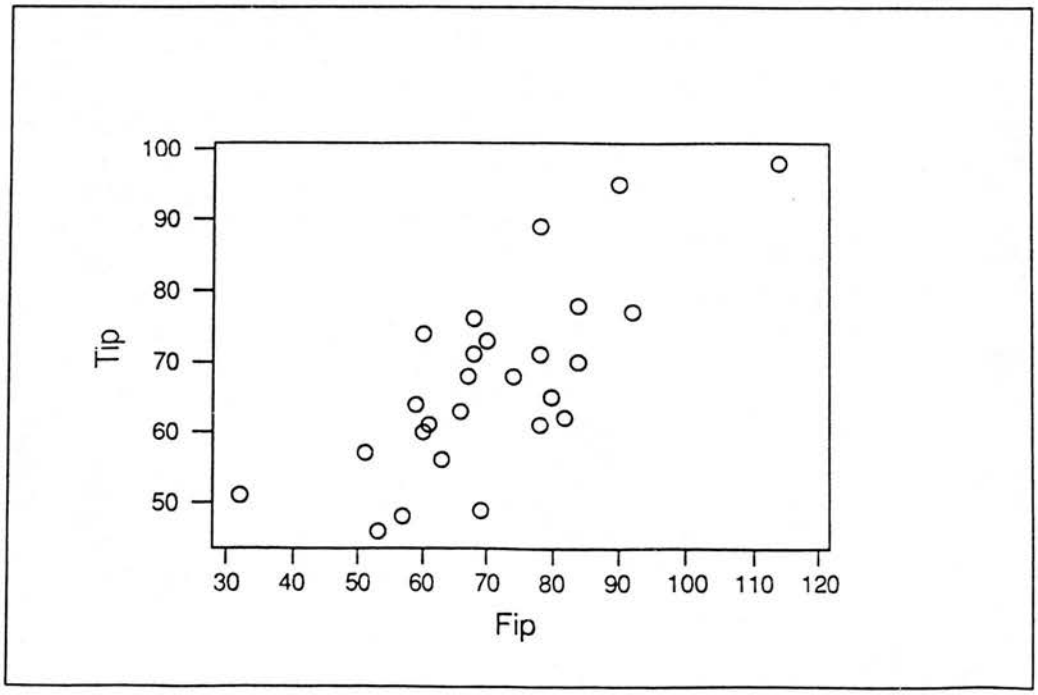

Figure 15. Information Processing A motor speed

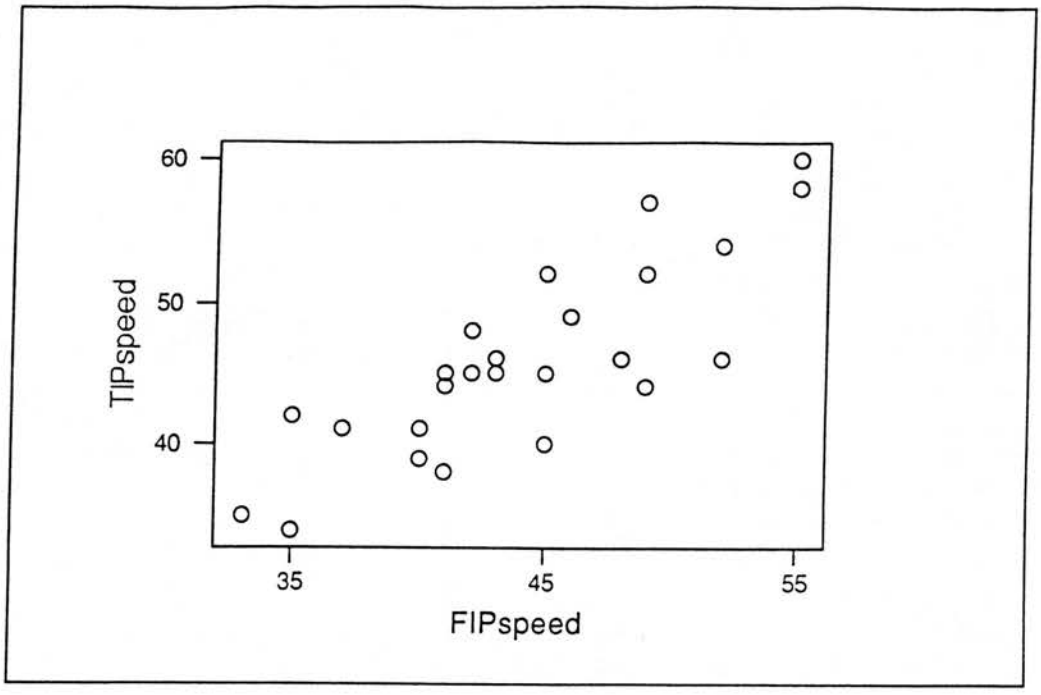

Figure 16. Information Processing A number of errors

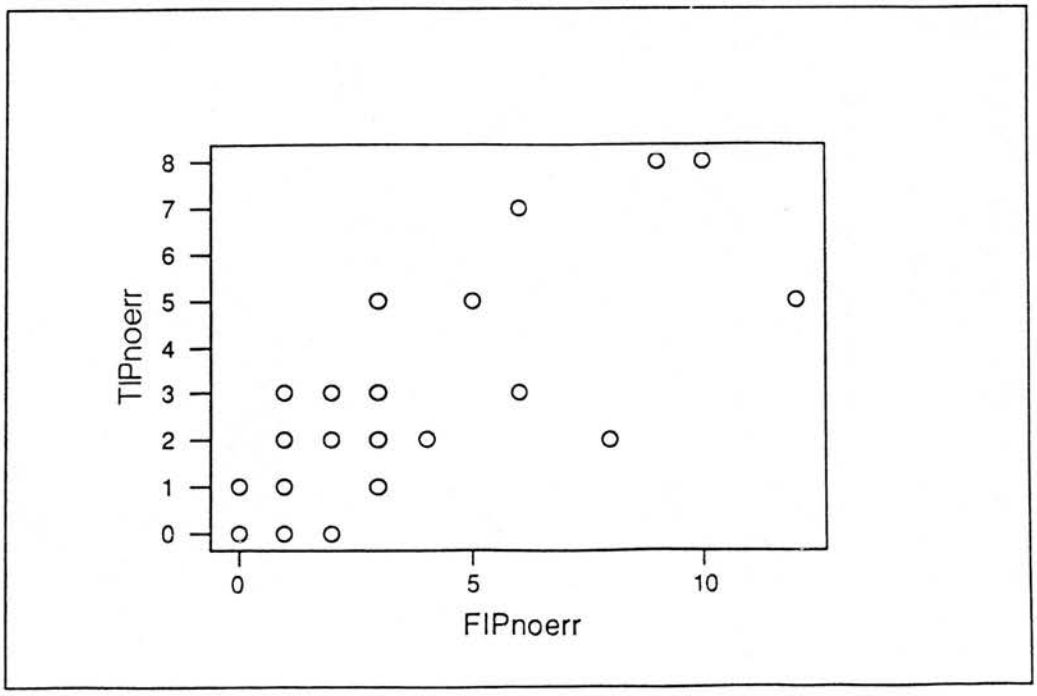

Figure 17. List Learning total

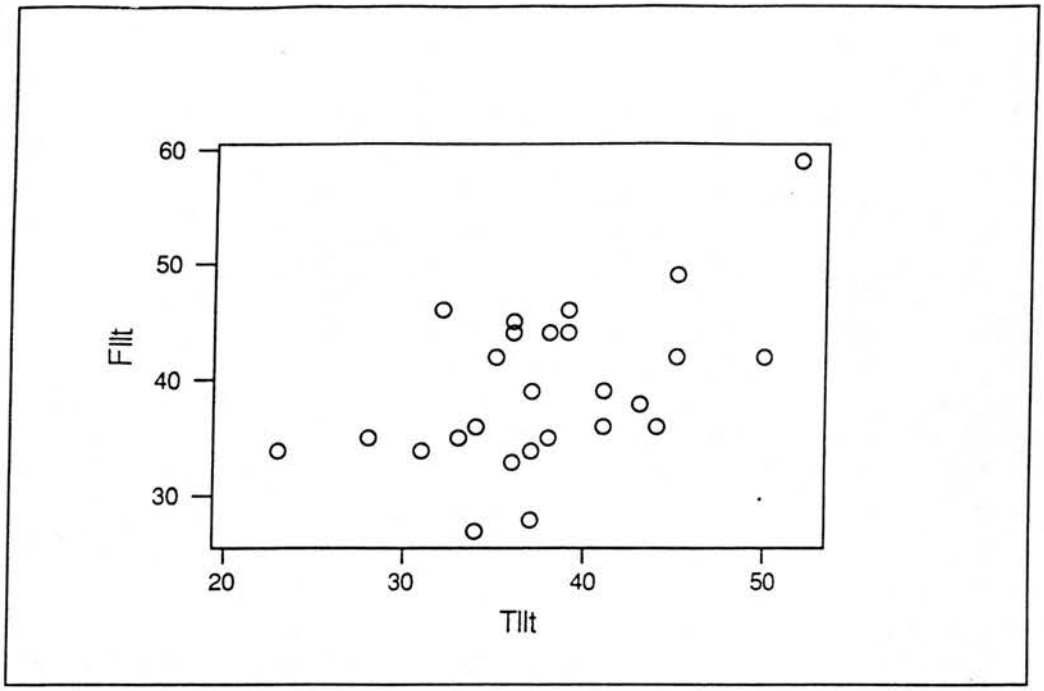

Figure 18. List Learning A6

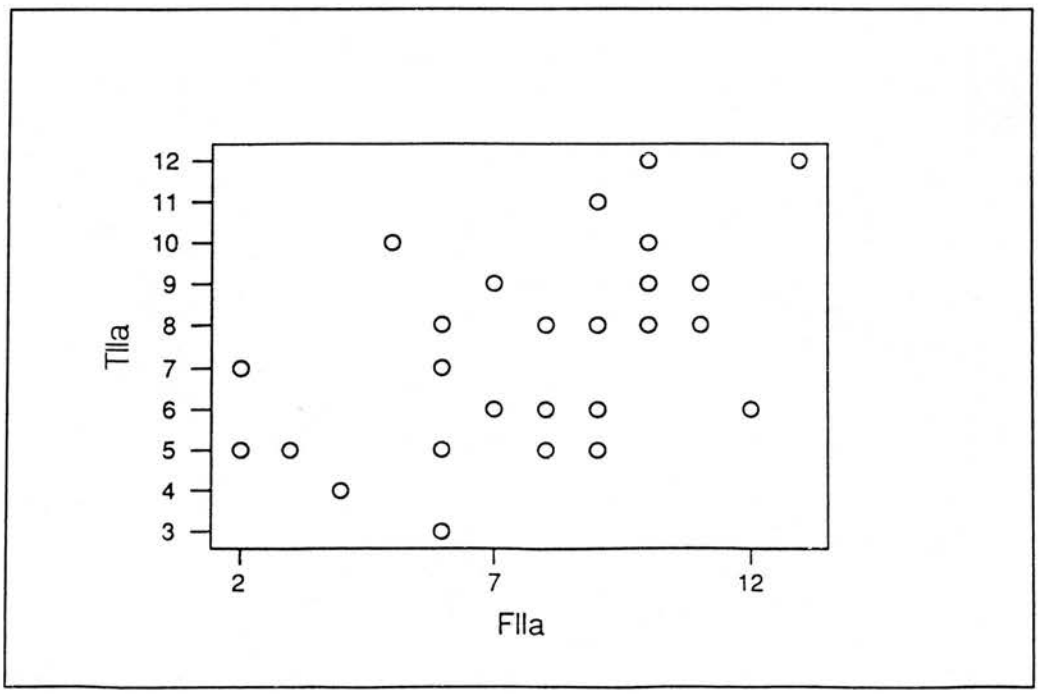

Figure 19. List Learning intrusions

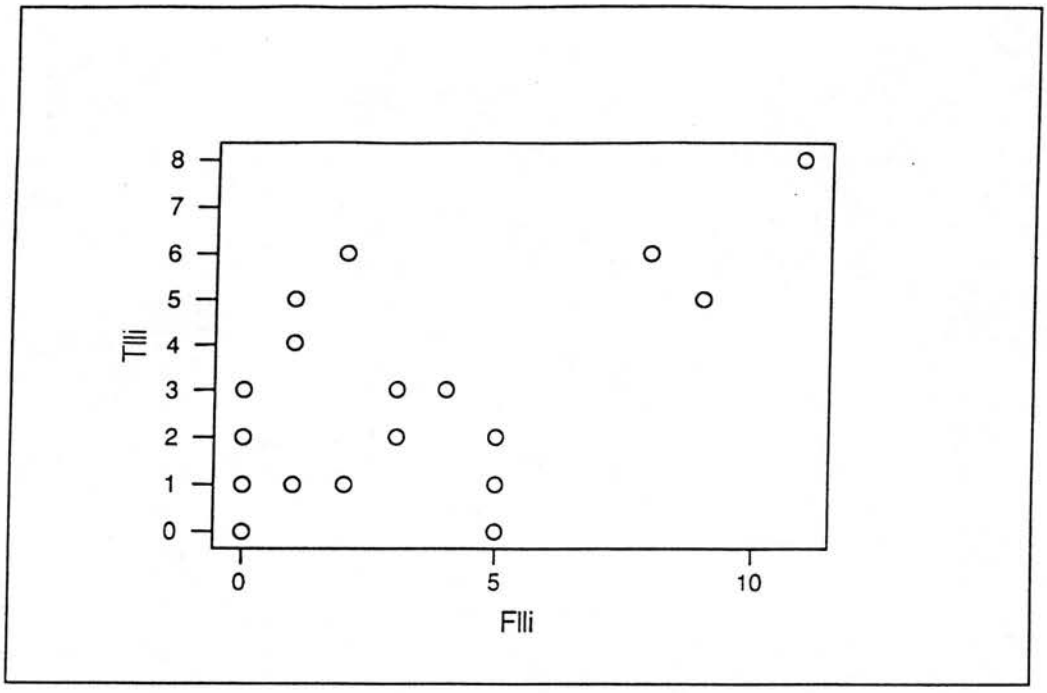

Figure 20. Figure Recall immediate